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SCIENCE MATERIALS AND ACTIVITIES IMPORTANT IN REMEDIAL READING

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Editor's Note. Deficiency in reading ability has become an acute problem in American schools and has contributed to failures in science and mathematics classes as well as others. Dr. Worthy, formerly of the University of Wyoming, is the Director of the Reading Clinic at Butler University. He has found that the use of science materials is very effective in improving the reading ability of school children. In this article he relates some of his experiences and ideas on the subject.

The increased importance of science in the public school program is accompanied by and correlated with the equally important element—reading. The importance of reading continues to receive a considerable share of attention as educators, parents, and the general public keep a critical eye on the teaching being done in our schools. A common complaint of many teachers of science and mathematics is, "They can not read." The parents say, "Many have their diplomas, but do not know how to read, write, and calculate." Many of us are aware that a weakness exists and we have traced the trouble to deficiencies in early language and reading instruction. Recently two young men who were high school graduates with good positions conferred with us to seek advice and help with their reading difficulties. Each stated that he realized he could not advance in his business, which was predominantly scientific in nature, unless he improved his reading ability. Each also stated that reading in school was never made interesting or meaningful to him and he could not understand why. Such public interest is to be

expected if one considers the fact that reading is one of the most important tools in living.

The technical nature of reading has so many aspects, and there are so many different types of reading to be used, that it is necessary for instruction in reading to be continued into the secondary school. This change in reading instruction has summoned the assistance of all teachers including science and mathematics teachers, who are apt to take a student's reading still for granted. With the nature of the reading process broadened to the extent that it is termed a thinking process, such abilities as to comprehend, to analyze, to judge, to organize, and to think problematically are highly important. This change in the nature of reading must be accompanied by a change in its place in the public school program, and a change in the techniques used in teaching the mastery of the present skills in reading. If we are to agree with the philosophy that interest and real experience on the part of the child are fundamentally important in teaching and learning, we must agree that many important skills, ideals, and attitudes will not appear in the program of the child except as the experiences of the child bring them to the surface. For this reason certain types of reading will be delayed until certain interests and experiences appear. This is particularly true in the case of elementary science, so many children are not taught to read scientific materials which involve skill in reasoning, judging, and thinking problematically. As one analyzes the aim of education it is thought of as a total process which attempts to utilize natural and compelling interests of the pupils; to help them to understand the world of which they are a part; to provide an environment which will give opportunity for real experiences with real things. Therefore, the experiences in school should be as real as those out of school in order that the child may develop into a well integrated personality. With the major emphasis now placed on the child, his interests and environment become paramount, and teachers must be influenced by both in guiding the child. In doing this the grade teacher is finding that the field of elementary science is one of the best sources from which she is to draw. It is true that science offers the fullest measure of understanding of the nature of reality in its many portions and phases.

Since it is the function of the school to select experiences in school which will most effectively arouse interests, provide an environment, and explain the world of which each individual

is a part, it is evident that the reading program must be revised to coordinate in practice with other phases of the curriculum including elementary science. It is also evident that many pupils have failed to read efficiently with the present reading program, and a large number are pupils with sufficient ability to read adequately. This fact has made it necessary to do a great deal of corrective work in attempting to bring these pupils up to the desired reading level. This condition has brought to us the problem of what is usually referred to as "remedial reading." The improvement of poor readers must be concerned mostly with the development of fundamental interests, attitudes, skills, understandings, and provisions of real life experiences. These experiences must stimulate, modify, and direct the growth of each pupil physically, mentally, morally, and emotionally. The teaching of reading under such conditions must be done with the viewpoint of child growth and development rather than that of subject matter mastery. With these factors before us, we are fully aware that reading materials are exceedingly important. Materials always have been important, but have not always received due consideration. Some critics have avered that the problem of materials have been not only neglected, but abused. When one considers that out of every five children who have reading difficulties, four are boys, causes for such conditions immediately bring up the problem of reading materials used. Also, another problem which is considered to have direct relationship with reading materials is that of the difference in the maturity of boys and girls of the same chronological age. It is our opinion that there should be a more careful selection of materials.

In examining the problem of materials we must remember that the child's environment is the source of the elements contributing to his growth as well as his primary area of interest. Since many of these factors are of a scientific nature, it seems reasonable to suppose that reading materials of a scientific nature would be logical to use as a large part of the remedial program. This supposition also holds true for the basic reading curriculum to help to create keen interests and resourceful attitudes. However, securing interest and attitude are not in themselves sufficient,—they must be maintained! To reach a child with a negative attitude and disinterested personality we found that it was often necessary to resort to materials of an unusual nature. Teachers of children of this type are succeeding by using a variety of science activities and materials.

In several years of experience with remedial reading groups we have found that scientific materials are a rich sources toward this end. Interest has been secured and growth in reading achieved more often by use of science materials and interest than by use of the materials ordinarily provided teachers of reading. In 70 per cent of the individual cases we have handled, interest was secured and more rapid reading improvement was made by using science materials and activities. A brief description of a few cases is presented.

Case number one was a boy fifteen years of age with an I.Q. of 134. He was in the eighth grade but he was four years and seven months retarded in reading. It was found that he wished to become a physician and among his scientific heroes was Pasteur. Materials about Pasteur's work were collected and rewritten for him. He discussed this material with his teacher, read it, and seemed to experience his first real thrill from reading. He then became interested in the operation of the metronoscope and learned to operate it and help with the instruction of younger children. In this way he read many different kinds of materials. In five weeks he made two years progress in reading and established confidence in his own abilities.

Case number two was a boy eleven years of age in the sixth grade with an average I.Q. His reading level was grade 3.2. He was void of interest and his attitude was the worst we had ever known. He definitely refused to read or do any kind of school work. The teacher took books away and began a search for something of interest to him. After working with the boy for about two weeks, the teacher found his interest to be deep-sea life. Riddles of deep-sea life were fascinating to him, and he became interested in the museum. His attitude changed. He was awakened for the first time. In five weeks his progress was one year and nine months.

Case number three was a lad ten and one-half years of age with high average intelligence. He was in the fifth grade with a reading level of grade 3.2. He had trouble with eye movements, and word recognition. He developed many interests but was especially interested in magnets and magnetism. This led to an interest in electricity and the life of Benjamin Franklin, which was followed up. He showed a reading growth of about three months in five weeks, and his interests were greatly stimulated and enriched.

Case number four was a boy eleven years of age with an I.Q.

of 90. He was in the fifth grade and had a reading level of grade 3.3. He was a careless rapid-reader without comprehension. He became interested in fish and the aquarium. So the material used in his remedial program was built around these interests. His habit of lip reading was practically eliminated and he made remarkable gains.

Many other cases similar to these could be presented showing that the child was reached through a science interest. In addition to the interests mentioned in connection with the cases described, the following topics were found to be attractive to the children and several as the major interest of at least one child: Pets, animals, birds, fish, sports, veterinary, chemistry, automobiles, penguins, drawing, music, electricity, and famous characters.

The "unusual" as a factor in teaching retarded and defeated children was mentioned. This factor cannot be stressed too much at the beginning of the remedial work with the child who has experienced a lost interest and general discord in his growth. The teacher should resort to varied activities and materials which will serve to give the child a different outlook on school activities and learning in general. The child must be awakened to the fact that his interests are important, and made to feel that it is important to develop his own interests regardless of what they might be. In the past there has been a lack of materials and general understanding of child activities to provide the child with the necessities of such a teaching program. But today there is an increasing supply of such materials designed to arouse interest and at the same time to inform the child. The Ohio State Department of Education has recently constructed a program of conservation of natural resources which offers many suggestions suitable for activities to use in arousing interest and integrating activities with the experiences of the child. Such topics as: "How Many Earthworms Are Working for You?" and "How Many Bumble-Bees for a Glass of Milk?" possess the unusual characteristics that usually appeal to children. The Basic Science Education Series by Bertha Morris Parker is another source of materials which will be helpful to the remedial teacher. There is an increasing supply of such materials and our teachers will profit by their use.

Vocabulary building exercises are indispensable and there are many good studies which teachers have available, but perhaps too few which have considered science interests and mate-

rials. Russell and Worthy made a survey of the science vocabulary of thirty-five science readers and this list is available for those who might be interested.

In conclusion it should be stated that many students go to high school and college with the necessary ability to read, but have not made proper adjustments sufficient to read the various kinds of required reading. All that many students need is a reasonable amount of guidance in practice with the various kinds of reading materials and their treatment.

THE HOME MEDICINE CABINET: A UNIT IN CONSUMER CHEMISTRY AND HEALTH EDUCATION

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In many ways the problem of reorganization of science instruction in the high school has reached a stage analogous to that of a building to be remodelled. The plans have been drawn in the form of objectives thoughtfully and critically formulated to meet the demands of general education. Certain partitions are to be removed and the interior of the edifice is to have different arrangement. Plenty of up-to-date material is at hand from which to select in organizing teachable units to meet modern educational requirements. But the classroom teacher cannot undertake a comprehensive revision of a course because of lack of time and facilities for supplying the students with satisfactory materials incident to such revision. Schools of Education with the necessary resources could do a great service by working out in detail units for classroom use by teachers who would cooperate in revising them. Perhaps this will be one of the outcomes of workshop courses for teachers being developed at leading universities. Widespread introduction of vitalizing elements into courses in science await the time when suitable teaching aids are available. These must meet classroom needs within the framework of the existing school organization. From the teacher's standpoint, the crucial question is whether the material is in form to keep adolescents profitably occupied in attaining ends that to them are manifestly worth while.

A project is most effective when developed for the class as a whole with sufficient flexibility to allow for differing interests and abilities. For instance, to teach a well-rounded unit in chemistry requires besides reading matter, carefully planned laboratory work, exercises and problems, related activities to promote as much student initiative as possible, and finally review and test material. The short unit discussed here is offered as an example of the direction that modification of the chemistry course might take to meet the criticism that is threatening the continuance of the separate science courses in high school.

Copies of the booklet *The Home Medicine Cabinet* were obtained from the U. S. Superintendent of Documents at nominal cost so that a copy could be loaned to each student. The contents of the booklet only partially meet the requirements for what one would like to do in view of the keen interest displayed by students in the physiological effects of chemicals. One recent textbook contains a section on chemistry and health but it is largely devoted to a discussion of vitamins and hormones, and is heavily loaded with vocabulary difficult to make meaningful and objective to a beginner.

Copies of a list of questions based on the booklet were first distributed, and after time was allowed for looking them over, the class voted on whether to spend some time on such a study, or to proceed with the next unit in the course. The vote in favor of the project was almost unanimous, and from a study of the booklet, brief answers to questions such as the following were written out in preparation for discussion.

1. What six kinds of remedies should the home medicine cabinet contain?
2. What does U. S. P. mean? How does this mark of quality protect the consumer in the purchase of drugs?
3. Which contains more reliable information about drugs, the advertising or the label? Why?
4. Discuss the use of iodine as an antiseptic.
5. Name two dangerous drugs sold for the relief of pain.
6. What stimulant is recommended and what is the dosage?
7. Why should the use of sodium perborate as a dentifrice be avoided?
8. Why are tooth bleaches not recommended?
9. What is the most that a mouth wash can do? What is the safest and cheapest one?
10. Why is no remedy for colds recommended?

In advance of the study, members of the class collected lists of ingredients in foods and drugs, as shown on labels and containers. This information was typed on index cards and these were mounted on a large bulletin board to lend objectivity to the discussions. Ingredients were bought to have the class make up a quantity of tooth powder according to a formula of the American Council on Dental Therapeutics, and a sample given to each student. The object was not to encourage the home mixing of such preparations, but to show that the ingredients used in widely advertised products have no magical properties, and are usually inexpensive. A check-list was prepared which students used to check the medicine cabinet at home to see whether it was properly stocked, and whether it contained poisons, unlabelled bottles and preparations that had deteriorated.

This unit correlates the work in chemistry with health education in line with one of the major objectives in education. Students are informed about products recommended for use as household remedies, and are made consumer-wise about the ever-increasing number of proprietary remedies offered for every conceivable ill. Some of this knowledge can be put to immediate use. In spite of the efforts to educate the public, the amount of money spent by the American people for patent medicines is said to be increasing yearly. Care is taken to avoid the psychology of fear resorted to in some radio "commercials" and to guard against anti-social attitudes in the discussion of the sale of products considered harmful. On the other hand, the improvement in trade practices that has come with emphasis on consumer education is pointed out. Related topics that may be developed are occupational hazards of chemical nature, disinfectants and fumigants.

Time devoted to this unit during the second semester need not weaken the course in chemistry as such. On the contrary, if we are striving to impart knowledge that will function in daily life, the student is helped in that most important stage of learning too frequently taken for granted—namely, application. He is taught to try to connect the textbook subject with materials in common use. The course as usually presented includes many topics that are useful only as they contribute to learning more advanced parts of chemistry with the result that students need a year's college chemistry in which to really assimilate the content of the high school course. Those students who will not take

the subject beyond high school are entitled to dividends on their efforts in the form of some immediate practicality. This can be attained by modifying the existing course, keeping as much of the theory and logical arrangement as contributes to economical learning.

Perhaps in this way high school sciences can avoid such indictments as the following: "Placement of topics and principles has been made, not by the psychological characteristics of the learner, but by the demands of the science. As the result of this attitude, many projects, topics, or units making heavy demands on physics or chemistry are developing under the direction of other teachers in the core curriculum. This statement is especially true in the field of consumer education." (Douglas: *Modern Secondary Education*.)

HOW TO MAKE THAT ENLARGING FRAME

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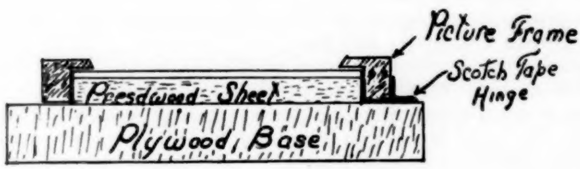
Do you want an enlarging frame or easel for making 5×7, 8×10, or 11×14 enlargements? If so, you can make one for a small sum of money and with very little work. Here's how.



Cross Section View

Go to your five and ten cent store and you will find an assortment of picture frames of varying dimensions. These frames are now being made to receive the more common sizes of photographic prints. Select the size or sizes that you want being sure that the frame is solid, the inside edges smooth, and that the corners are square. Carefully pull out the clips that hold the back in place and remove the back and the glass. The glass is not used in making the easel but has many household or photographic uses. The frame will cost from 15 to 25 cents depending

on the size selected. You will also need a piece of $\frac{1}{2}$ inch plywood about one inch larger than the external dimensions of the picture frame. Plywood is used because it has only a slight tendency to warp and the base must be flat. Needed also is a piece of presdwood the exact size of the print you wish to make. As these small pieces of wood are of small value they may be had for little or nothing. Center the piece of presdwood on the base and tack it firmly down. The heavy cardboard backing that comes with the picture frame is now glued to the top of the presdwood sheet. This cardboard is usually smooth and white in color and furnishes a good surface on which to focus the projected image. Now fit the frame down over the cardboard, and make a scotch tape hinge across one end as in the illustration and your easel in finished. If you find it desirable a pair of light metal hinges may be substituted for the tape which does have to be replaced at frequent intervals. The frame furnishes a uniform margin about 3/16 inch in width and the weight of the frame holds the enlarging paper flat. The paper is always in position in this device, an advantage that is usually found only in the high priced easels.

APPLIED MATHEMATICS IN NATIONAL DEFENSE

The nation's first center where engineers, mathematicians, technicians and other specialists in defense production can devote their full time intensively to problems of higher mathematics as applied to industry will be set up at Brown University this June.

Beginning with a summer session which can be continued through the academic year 1941–42, the special training program is being launched as an answer to what a committee of the National Research Council, reporting to the National Resources Planning Board, describes as a "critical need" in the country's defense efforts.

"Before the war the United States depended upon Germany and other European countries in applying mathematics to industrial problems," President Wriston pointed out. "Today adequate exploitation of aerodynamics and other fields bearing directly upon defense activities must await the basic work of mathematicians in this country."

Brown has accordingly gathered a group of professors, lecturers, research directors and experts associated with industry, who will come to the university from all parts of the nation. They represent "the most outstanding men available" in the field of applied mechanics, President Wriston said.

Four courses in applied mechanics are to be offered—"Partial Differential Equations," "Fluid Dynamics," "Elasticity," and a seminar for weighing current research problems in elasticity and fluid dynamics. As applied to particular engineering problems, the work of the summer session will deal with highly specialized phases of aeronautics, stresses in machinery, ship construction, ballistics and the detection of submarines and planes.

GEOGRAPHIC TESTS: A TOOL OF GUIDANCE

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This study deals with one particular aspect of geographic testing, which for the purpose of discussion we have chosen to designate as Day-to-day Testing. The phrase, "Geographic Tests," is a broad one and like the chameleon its shade of meaning often changes to fit the background of the user.

It would be interesting to know what mental images loom up from your teaching past when the term, "Geographic Test," is mentioned. Some teachers will associate the term with objective standardized tests. Administrators will probably think of "Geographic Tests" in terms of published tests; tests whose objectivity, validity, reliability, and practicality have been established beyond any question of a doubt. Others may recall geography examinations given prior to the grade period. They may think of testing as an occasion for collecting incriminating evidence to hold over the heads of those who have failed to jump the hurdle and as a time to reward those who have made the grade. The term may remind some of unit or sequential tests such as the pretest, the presentation test, the assimilation test and the recapitulatory or summarizing test.

The foregoing types of tests have had wide use and despite abuse have played an important role in mass education. In the hands of teachers who are sensitive to individual needs they may serve as effective tools of guidance. However, it is believed that too much emphasis has been placed upon their use in ranking pupil performance for the purpose of giving grades, in cataloguing pupils homogenously and in viewing the tests as ends in themselves rather than as a means of evaluating continuous progress.

It is probably true that all past experiences give meaning to our concepts, but whatever meaning geographic testing has had in the past, it should include in the future the individual day-to-day testing that takes place in the daily instructional program. To some this activity has become synonymous with testing. Others may be slightly baffled by the use of the term as applied to what they may consider guidance or plain good teaching. It is believed that this informal day-to-day type of testing measures achievement not only as well, but in many cases far more adequately than formal, periodic and mechanical types of

tests. It is to this type of testing that the balance of this discussion will be confined.

What is the Nature of Individual Testing in the Daily Instructional Program?

Day-to-day individual testing is a continuous audit of progress. It aims at measuring the attainment of students where they are rather than where the formula says they are supposed to be. Such a method of testing takes the student from the solid ground where the teacher finds him to the next level of learning. It does not attempt to start off from some theoretical point beyond that which the student has actually reached. It does not leave behind him an intellectual vacuum through which he has never traveled. It therefore has obvious advantages over the kind of tests that set achievement beyond the immediate attainment of the student with the belief that incidental learning and considerable coaching will help him to arrive at the proposed goals eventually.

The general principles that have been stated thus far may be applied to almost any subject. Let us now consider briefly, just how day-to-day individual testing applies to geographic education. It is assumed that geography is a socio-natural science as distinguished from the social sciences and from the natural sciences. From this point of view, tests that measure geographic education must not be focused upon miscellaneous and isolated facts. They must be directed toward such attainments as geographic understandings, abilities, and attitudes. Any means by which evidence is secured as to the attainment of these values is a test of geographic education.

How test situations may arise and the use that the teacher may make of them may be seen from the following example. In approaching the study of the three small countries, formerly known as Belgium, Netherlands and Denmark, the teacher may show pictures of commercial, farming and manufacturing activities that are typical of the important kinds of work carried on in these countries. When it is known that the students understand the kinds of work pictured, they may proceed to the next step of determining just which of the three types of activities shown are most important in each country. This activity provides for disconcerting data which lead the students to ask why farming is more important in Denmark than in Netherlands and Belgium; why manufacturing is more important in Belgium than in Den-

mark and Netherlands and why commerce is more important in the Netherlands than in Belgium and Denmark.

In this simple activity there are a number of test situations. The teacher for example, is able to test not only the student's ability to read and use information from a picture but also his ability to raise and delimit a problem for further study. If the pupils have a textbook or supplementary materials from which they can collect facts which help to explain the importance of farming in Denmark, of manufacturing in Belgium and of commerce in the Netherlands, the pupils may be further tested while they go about solving the problems that have been raised.

While working with the pupils, the teacher may learn something about their methods of attack on a problem, their use of such geographical tools as maps, pictures, graphs, statistics, textbooks and reference materials. She may check on their ability to draw inferences and hold findings as tentative until checked by one or more reliable sources. It should be noted that this kind of testing can be carried on more effectively with books that are open than with books that are closed.

This day-to-day individual testing may be used in measuring what has been acquired during a given period and may also be used for testing the permanency of learning over a long period of time. In a study of the central mixed-farming region, for example, the student becomes acquainted with the distinctive type of farming that is carried on in this section. If, many months later, he recognizes the kind of farming in the Mohawk Valley as typical of that studied in central Illinois, the teacher may consider this a test of his ability to recall and recognize information previously acquired. In fact every time a pupil uses known information in a new situation, he has been tested in one of the important phases of learning.

The few examples just given should show that many of the important objectives of geography may be tested with economy of time and effort and without the use of special tests, if teachers will take advantage of the many test situations that occur each day.

Geographic testing must not be confined to school experiences alone. When, for example, children bring in relevant news clippings, relate current happenings or events to the problem at hand, draw upon opportunistic experiences such as trips in supplementing information, report significant facts that they have heard over the radio, recall motion pictures showing pertinent

facts, collect typical specimens of regions being studied, or read recreational books that help to enlarge understandings, you have evidence of progress toward some of the desired objectives in geography. It should be noted that a testing situation such as this is not based solely on the so-called classroom activities but that it includes in addition, an evaluation of learning that may have taken place in the out-of-school time.

In conclusion then, we see that where instruction is closely directed toward basic geographic understandings and the teacher is sensitive to the progress of the students toward these goals, there is little need to think of testing as something formal, mechanical, or quite apart from the regular class room work. In fact, appraisal of every activity in or out of school which directs the efforts of pupils toward geographic understandings may well be considered a geographic test. In this sense testing is a tool of guidance. It is a tool that is used from day to day to evaluate results attained at any stage of learning and which points the direction for further progress.

AREA MEASUREMENT OF THE STATES

A new area measurement of continental United States, completed by the Census Bureau, supplemental to the 1940 Census, has resulted in an increase of the land area of 3,352 square miles, according to an announcement by Acting Director Vergil D. Reed.

Although the new measurement increased the land area, it decreased the inland water area 7754 square miles so that the total area of continental United States now is 3,022,387 square miles, compared with 3,026,789 square miles previously. This is a net reduction in square miles of the continental area of 4402.

No state escaped alteration of its officially accredited square mile area.

This is the first basic remeasurement of the United States since the one prepared by Henry Gannett for the Tenth Decennial Census of 1880. At each Census since 1880 the Census Bureau has made alterations to conform to known changes in local areas. The Bureau has now embodied all of these corrections necessitated by boundary changes, map improvements, improved surveys and court decisions fixing boundaries. The new measurement eliminates much water area claimed by coastal states, some of which extended their boundaries three leagues, some six, and some twenty. Since there is no legal standardization of such boundary claims, the Census Bureau eliminated coastal waters and confined the national boundaries to principal land lines, including embayments as inland water area. Chesapeake Bay, Puget Sound, Long Island Sound and similar waters were not included as "inland waters."

The Bureau released a detailed breakdown showing the changed areas of such state, and, later, will issue a detailed breakdown of all minor subdivisions.

SOME VOCATIONAL IMPLICATIONS OF BIOLOGICAL SUBJECTS

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Teachers are likely to become so engrossed in teaching their subject that they often fail to tie it up with the vocational potentialities of their students. Our purpose today should be to make ourselves more conscious of the vocational importance of biology in order that we, in turn, may transmit this viewpoint to those in our classes.

Naturally we shall interpret the term biology broadly as the science of life, whether it be in plants, animals, or in any other form. Our first question is: What are the areas of work which involve biological training? Any classification of such work must be more or less arbitrary, but we can briefly review the different types of work that cluster around the following four areas: medical and health services, agriculture, conservation, and industrial processes.

Let us consider first the medical and health service field which should include all types of health and medical services, the field of preventive medicine, and public health work. This is, of course, the most obvious field, since biology was first studied as an aid to medicine, and we still more or less associate it with that field. I need not go over all the different medical services and indicate the need of biological study for each. As far as medicine itself is concerned, we are aware of recent trends requiring a broad background in the general sciences, including biological science.

When we think of some of the more specialized health services, we realize how biology cuts through them all. For example, in *physical therapy*, it is important for the practitioner to know the function of the digestive system, the heart, the muscles, and the bone structure. The effects of radiation and heat upon the body must also be known. Certainly such knowledge can come only from certain preparatory work in the biological field. Likewise, in medical laboratory technical work, the application of biology becomes a prime requisite, and we find such organizations as the Board of Registry for Medical Technologists requiring two years of college including eleven semester hours of subjects in this field. Of course, additional work along this line is

given in the training courses at the approved training schools whether they be on the list of the Registry Board or the American Medical Association.

In the field of *nursing*, too, a great deal of biological training is necessary. With an increase in the age level and the amount of education required for entrance into schools of nursing, moreover, we can see the possibility that general biology courses will form a background for the training of all prospective student nurses. Some of us recall some conferences with the Illinois State League for Nursing Education a year or so ago, where it was indicated that the proper course of bacteriology at the junior college level would be a desirable preparatory subject for student expecting to enter nurses' training.

A third type of medical work for which training has more recently been established in many places throughout the country and on which there has been considerable discussion as to the scope and best type of training, is *medical secretarial work*. It is generally conceded that there is a place for a type of specialized secretarial service in the medical field which would involve some knowledge of certain routine tests, procedures, and medical terminology. This type of training is of course, still in an experimental stage. The aim of such training is not to produce clinical technicians and in no sense would a person so schooled be qualified to serve as a medical technologist. Nevertheless, when we have any type of such preparation, it is recognized immediately that biology becomes important in teaching whatever is taught with respect to office laboratory tests and terminology.

There is still another field. We usually do not think of *library work* in any of its phases as a part of the medical service group; yet we must remember that we have not only medical record librarians but that many industrial concerns and other types of libraries need people who know medical terminology sufficiently well to be able to catalog books, digest articles, and do other types of work where such information is indispensable.

Finally, any discussion of the medical field certainly would be incomplete without mention of *public health work*. With strong emphasis today on matters of sanitation and other factors influencing the general health of the public, there are many new and old types of medical services used in this field.

So much for medicine and public health. Our second area is that of agriculture. Here again we should use the term in its broadest sense, to include agronomy, horticulture, and veteri-

nary science. If we look into any one of these divisions we find that striking developments have been made in recent years and that these developments have come from well trained specialists in the various fields of scientific agriculture. The agronomist who carries on projects and experiments in the selection and improvement of crops, the animal husbandman who works with the breeding and development of all types of farm animals, the soil surveyor who analyzes soil conditions and experiments by adding materials needed by plants, the seed analyst who tests various seeds to determine which variety will produce the finest yield, the plant pathologist who investigates processes of plants —these are all examples of people whose jobs demand acquaintance with various branches of our teaching subject. We are told that the field of veterinary science is increasing in importance and that desirable openings have been available in this field in recent years.

A few months ago the Bureau of Occupational Research was called upon to make a survey regarding the desirability of offering a course in vocational horticulture in one of our large technical high schools. Contacts with many different agencies such as greenhouses, landscape gardeners and the Chicago Park Board District seemed to indicate a need for some type of training in this field. At present, one can get such schooling only in the collegiate courses in landscape architecture, but a course offered at a lower level would apparently fill a need for the vocational competence of a fairly large number of boys who annually find employment in this field in Chicago.

Our third area of work, that of conservation, is in a way hard to segregate from agriculture; yet it is definitely of a different nature. We are all aware of the recent efforts to preserve our forests, wild flowers, fish, birds, beneficial insects, and soil. These efforts have led to the employment of experts and assistants in each of these fields, all of whom must have had basic training.

Our fourth and last area of work is that which, for want of a better term, I have called industrial processes. For the most part, it involves the preparation of foods and pharmaceutical products. With new regulations to safeguard the purity of foods, and with the ever-present endeavor to increase the marketability of food products, we find most large food houses paying attention to biological problems and employing people to assist in this work. Much is also being done on food preservation and in the

best ways of packaging food products. A very few years ago, for example, we heard much about canned beer, which was a revolution in the brewery industry. The development of special paint for the inside of cans in order that acid products such as grapefruit and orange juice as well as vegetables containing sulphur could be canned and preserved, is another example of how biology has been put to use. In the food industry we find the work of the biochemist, making special efforts to develop foods with certain vitamin contents. Evidence may be found in the advertising of many food companies, such as Quaker Oats with its Vitamin D, the puffed wheat and puffed rice companies, and even more unusual, the dog food advertisements!

In the pharmaceutical houses it goes without saying that much is being done in the way of development and preparation of vitamin products and in working on the big problem of hormones. To realize this, all we have to do is to read present day advertisements or go into a corner drugstore and glance over the long list of pharmaceutical products now on the market. There must be research experts and production workers whose background is such that they can develop and manufacture these products.

The four areas are, as I said earlier, purely arbitrary, but I think they help us to crystallize our thinking about the wide vocational possibilities of biology. Many divisions of the biological field cut through them all. For example, bacteriology is extremely important in medicine and public health, since it deals with disease-producing germs, sewage disposal, water filtration, milk inspection, disease prevention and treatment by the use of anti-toxins, vaccines, serums, and medical diagnosis. It is, however, equally important in agriculture and in industry. Likewise, entomology is as important to the field of medicine and public health as it is to agriculture and conservation. Dr. Rufus Cole formerly of the Rockefeller Institute for Medical Research indicated the breadth of all biological subjects when he said: "That some sciences are more closely related to medicine, in their methods and fields of endeavor, than are others is obvious. Biology, comparative anatomy, embryology, bacteriology, protozoology, botany, anthropology, human anatomy, and others, have many close affiliations with medicine. . . . But none of these contributing sciences are medical sciences. None of them should be trammeled by serving medicine alone."

So far we have dealt with the areas in which biological workers

would be employed. A next logical question is: Where do such workers find employment? It has been estimated that in the United States approximately 170,000 positions are occupied by persons trained in biology. There are at least five specific fields where these workers are employed.

One field is the government. In fact, it is the largest field. In most municipal governments, for example, we have the health department, the water department, the sewage disposal department, and others which use many types of workers who must have a biological background. Botany and related subjects are essential in park districts in the department of agriculture, public health and conservation of the various states, and in many departments of the Federal Government. Foremost in the Federal Government is the Department of Agriculture which employs approximately 25,000 persons and second in importance is, perhaps, the Department of the Interior, including the national park service, Indian affairs, the geological survey and others A better idea of the types of such workers employed by the Federal Government may be gained from considering the number of persons examined and the number who passed civil service examinations involving biological training given by the Federal Government for a given year ending June 30, 1939. It is observed that a total of 22,925 persons took such examinations of whom almost 9,000 passed. Any casual survey of civil service examination announcements posted in public places will reveal various types of such examinations and the qualifications necessary for eligibility.

A second field that should be mentioned without much discussion is private practice.

The third field is that of hospitals, clinics, and other employers of medical workers. As the trend toward group hospitalization plans, clinics, and public health programs continues, we shall expect to see greater opportunities for employment here. Certainly, we have not reached the point where the majority of the people in the country are receiving adequate medical care.

The fourth field is industrial firms. I have already mentioned the activities of food industries and pharmaceutical houses in the development and preparation of commercial products. It is estimated that already over ten thousand persons with training in biology are employed by such commercial concerns. The present trend indicates increasing opportunity in this field.

The fifth field belongs to workers in education and in research.

If the demand for persons with biological knowledge increases, there must be teachers of biology. As far as research is concerned, this is probably one of the most fertile fields for the person who has the mental and personal requirements necessary for graduate study and for work of this nature. In this respect, I should like to mention the possibility of combining biological training with training in chemistry and physics. Such a combination is, of course, necessary in many types of work already mentioned, but I wonder if we should not consider making even more combinations.

Dr. Karl T. Compton, President of the Massachusetts Institute of Technology, at a recent address at the twenty-second annual meeting of the American College of Physicians pointed out how medical men are dependent upon equipment and help which is the product of physics and chemistry, saying "Very, very few biologists or physicians are trained in the technics of physics and chemistry, or have any understanding of the concepts and methods of these sciences which may be applicable to their own science; conversely, very, very few physicists or chemists have any knowledge of the problems of biology. So I believe that one forward looking step may be taken by the parallel training of young scientists in biology, physics, and chemistry."

Dr. Compton goes on to say that, of course, some biophysicists and biochemists are already doing excellent work, but that the whole field has just been touched. He then outlines a five year college course in what he terms "biological engineering."

This same idea is expressed by Dr. Edward C. Schneider, Professor of Biology, Wesleyan University, Middletown, Connecticut, in a recent address at an annual meeting of the Association of Medical Colleges. Said he: "Let us not forget that neither biology nor medicine is merely applied chemistry and applied physics. We are just beginning to become acquainted with the biophysicist; the biochemist we have known for some time. Experience has shown that the good biochemist is not merely an organic chemist who dabbles in biology, but that he is also a well trained biologist; that is, he has the biologist's understanding of the living machine, as it is found in one or more kinds of animals or plants. So, too, the biophysicist will be the physicist who takes a place among biologists to learn from them of the mystery of life and to collaborate in the solution of this mystery."

Is this not a challenge for the young people in your classes who have outstanding ability?

A consideration of vocational biology would be incomplete, especially here, without some mention of the function of the junior college in such training. It is obvious that this function lies in two areas: *pre-professional* training and *terminal* training. Many junior college students are pre-medical, pre-pharmacy, pre-technology, or pre-nursing. In most of these curricula, the pattern is fixed; biological subjects are the basis for future vocational training. Some junior colleges are even cooperating with schools of nursing so that student nurses may take specific science courses in the junior colleges and receive credit for them at the nursing schools.

As far as terminal curricula in this field are concerned, we might be inclined at first to believe that opportunities are limited because so many jobs require at least college graduation, An analysis this year, however, based on reports of 426 junior colleges, of which 293 offer terminal curricula, indicates the frequency of the following courses in the biological field and the total enrollment in them:

Course	*No. of colleges offering*	*Enrollment*
Nursing	59	975
Agriculture & Forestry		
General Agriculture	57	1254
Forestry	32	381
Floriculture	7	38
Laboratory Technician	6	46
Medical Secretarial	33	460
Mortuary Science	10	36
Civil Health	2	108

These data indicate some types of curricula that can be given on a terminal basis at the junior college level. Naturally, they should be geared to the needs of the community.

As stated at the outset, my purpose has been to summarize and to crystallize our thinking about the vocational possibilities of this very important subject, biology. If this means anything at all, it should be of help to us in pointing out these possibilities to students in our classes. Indispensable as a specialized, organized system of guidance is, it can never fully take the place of the teacher. This is particularly true in a subject such as ours

which has so many vocational implications. If these points constantly can be brought to the attention of students, much good undoubtedly will be done. I think Dr. Schneider, whom I quoted earlier, summarizes this point very well when he says "Any teacher of biology of long experience can cite instances of men who have become leaders in medicine who found their interest in the subject in the introductory course, sometimes as late as their senior year in college. He can also cite many instances of men who were persuaded to turn to other phases of biology or specialize instead in another field of learning. The introductory course stimulates a lifelong interest not only in biology and medicine but in public health, in agriculture, in forestry, and other fields of human welfare."

CATHODE-RAY OSCILLOGRAPH DEMONSTRATIONS IN HIGH SCHOOL PHYSICS

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Easy demonstrations with the Cathode-ray oscillograph are sometimes difficult to find, and still more difficult to devise if one is not too well acquainted with practical radio and electronic apparatus. The experiments described here were found easy to set up, and effective to use in the study of sound.

I. VISUAL SOUND WAVES

The oscillograph is set up beside an ordinary radio, which must be equipped with ground and aerial for ordinary reception. The ground post of the oscillograph is connected with a wire to the ground terminal of the radio, or to any other convenient ground. From the "vertical" binding post of the oscillograph, a wire of some 5 or 6 feet is extended. The last few feet of the other end of the wire are coiled up loosely and merely slipped down over the detector tube of the radio. The proper tube can be found experimentally, if necessary, by slipping the coil down over first one tube, then another. No connection is made, of course, to the end of that wire.

Now if the radio is turned on, and the proper adjustments made on the oscillograph, the sound waves show up nicely, providing that the volume on the radio is ample. If insufficient volume is used, there may be no sign of waves on the Cathode-

ray tube. With the oscillograph used, the RCA No. 151, the following approximate adjustments were used: Vertical Amplifier off, Horizontal Amplifier set on timing, Vertical Gain 0, Frequency 0, Range 1 or 2, Horizontal Gain 65. Since there are no connections made to the Horizontal binding posts there is no use for the Synchronizer.

II. Study of Individual Sounds

For study of individual sounds, similar connections may be made to a public address system. The coil from the Vertical binding post is placed over the appropriate tube, found experimentally as before. Sounds then made before the microphone become visible. Again, it may be necessary to use more than ordinary volume on the amplifier. Essentially the same adjustments are made on the oscillograph as in the preceding demonstration, with of course, the necessary adjustments on the microphone controls. In all experiments it is essential to have good tight connections.

Sound waves of varying pitch and composition may be observed. Various letters of the alphabet representing pure sounds, and others of complex composition, are interesting. Whistling at different pitches shows up well. Many variations, at the will of the operator, are possible, of course.

(Acknowledgement is made to Mr. Iley Winn, local radio technician.)

STARTLING COLOR CHANGES OF STAR SEEN FROM SHIP IN TROPICAL PACIFIC

The star Sirius, changing in color from red to light green, was the startling sight observed recently from a ship in the tropical Pacific Ocean, west of the Galapagos Islands.

In a report to the Hydrographic Office of the U. S. Navy, the observer, whose name and ship are not revealed, says that he was taking a sight on the star, when he noticed the color changes. Then he looked through binoculars, "and it was found that nearly all the colors of the spectrum were included in its changes." Sirius was then just rising in the east. As it climbed higher the colors faded.

Such an effect is an exaggerated form of the familiar twinkling. As the star's light passes through regions of the air of different temperatures it is bent one way, then another. When the temperature differences are unusually great, the air acts as a prism, and spreads the beam out into an actual spectrum. Because of the movement of the air and also, in this case, of the ship, the observer sees changing parts of this spectrum, and hence the changes of color.

FIRST AID SUGGESTIONS FOR ELEMENTARY SCHOOL TEACHERS

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EDITOR'S NOTE. In this day and age of diversified activities in the elementary schools, teachers often find themselves in a situation where first aid treatment is necessary to protect the health of a child. In the following article Dr. Shrader has given up-to-date first aid suggestions that will serve the classroom teacher in most school situations. It is the editor's suggestion that after you read this article you put it in the top drawer of your desk and keep it for ready reference.

This article is not intended to be a comprehensive treatise on first aid management. It includes a brief outline of the more common injuries which the elementary school teacher will be called upon to handle, such as those arising in the classroom, on the playground, or on the field trip. Remember that first aid, by definition, is the immediate, temporary treatment given before a physician's services are obtained. To most persons, first aid means to do something in a hurry, but in reality the element of rush is rarely necessary. There are only two emergencies where seconds count, namely: profuse hemorrhage and asphyxia. It is not so important, in many cases, to know what to do, as it is to know what not to do.

Medicine is far from an exact science like mathematics or physics. Consequently, doctors may vary slightly in their opinions on certain phases of treatment. That is to say, there may be several means to one end. It must also be remembered that treatment must always be individualized, both as to the patient and to the circumstances.

I. GENERAL PRINCIPLES

There are certain general principles which are applicable in the management of all first aid problems that may arise in dealing with children. *First of all*, always keep calm. Children are quick to sense a teacher's distress, and this will most certainly aggravate an unpleasant situation. For example, walk, do not run, and speak quietly. Secondly, it is wise to ease the pain promptly. Much can be accomplished toward this end by distraction of attention. Have the child grip one hand with the other and squeeze it tightly, or close his eyes tightly, or hold his nose and breathe through his mouth. Numerous other examples

could be mentioned—any little thing which will distract his attention, and at the same time give him the feeling that he is doing something to help. It is good psychology to allow the child to perform as much of the first aid treatment for himself as practicable. A third suggestion is to always encourage the child by commending his endurance and manliness. Never shame a child in front of his classmates, no matter how trivial the injury.

II. First Aid Treatment of Cuts and Small Open Wounds

Shock and Fainting. Injuries likely to be encountered are rarely so severe as to produce a condition of shock. However, some children become faint and nauseated at the sight of blood. The head should be lowered, either by having the patient bend over in his chair so that his head is between his knees, or by having him lie flat on his back with his legs elevated, if possible. Never use a pillow. Inhalations of aromatic spirits of ammonia are often beneficial. The oral administration of this drug is seldom justified as it is more apt to cause nausea and vomiting. Never give an unconscious person a drink of water. It is not necessary to drench the individual. Warm, moist cloths on the forehead are better than cold applications. Vigorous massage of the limbs toward the heart is a useful circulation stimulant.

Control of Hemorrhage. Unless a large artery has been severed, the most valuable, single procedure in the control of bleeding from small wounds is direct pressure over the bleeding area by means of a sterile gauze compress, or simply a clean cloth. The mistake is often made of removing this every few minutes to peek at the wound. Maintain constant pressure for 15 to 20 minutes to afford a chance for the clot to form. Elevation of the injured extremity will lower the blood pressure so that bleeding will be diminished. Scalp wounds bleed quite freely, and they should have constant pressure until a physician's services can be obtained.

Christopher states, "In the average man the sight of blood invariably invokes the idea of a tourniquet. As a result, the tourniquet has been perhaps, much misused, and done more harm than actual good." The common error is to apply the tourniquet tight enough to occlude the venous return, but not tight enough to stop the arterial flow of blood into the particular extremity. This, naturally, only causes more profuse hemorrhage. Actually, there are surprisingly few instances, where a

tourniquet will do more good than direct pressure over the bleeding area. The second error in application of a tourniquet is in making it too tight so that pressure on nerve trunks causes a transitory paralysis. Use tourniquets only when the person is obviously losing considerable blood from an extremity, i.e. traumatic amputation or its equivalent.

Cleansing of the Wound. The importance of cleansing a wound thoroughly with soap and water has in the past been greatly underestimated. No antiseptic or combination of antiseptics can begin to sterilize a wound safely, if thorough scrubbing with a brush, soap, and water, has been omitted. A badly contaminated and lacerated wound should be cleansed by a doctor.

Antiseptics. After the wound and the skin adjacent have been cleansed with soap and water, and all foreign bodies removed from the wound, it is then ready for application of an antiseptic. An ideal antiseptic is one that will destroy the most germs while producing the least damage to the tissue cells. The cell is the all-important unit in combatting infection and bringing about tissue repair. Strong antiseptics often hinder this process. We must not underestimate the natural defense reaction of the body to infection. It is not necessary to kill the invading bacteria outright, only to inhibit the growth of the bacteria. In other words, weaken the bacteria without weakening the natural defense processes of the body. The time-honored tincture of iodine has been replaced by safer and more effective agents. The alcohol may evaporate as the solution ages, and severe tissue damage may result from applying this concentrated iodine solution. Also burns have been produced by repeated application of fresh iodine solutions. Iodine may be mistaken for argyrol, and thus cause severe damage to the eye, or nasal mucosa. Another great disadvantage, especially for use with children, is that it smarts severely. *Merthiolate* and *Metaphen* are two highly efficient and safe antiseptics, but they also have the disadvantage of causing intense stinging for a few moments. For the first aid treatment of small cuts or abrasions suffered by children, 2 to 4 per cent aqueous mercurochrome is recommended. Children will volunteer for this treatment sooner than for iodine application. It does not sear the tissues as does tincture of iodine and penetrates wet wounds better. It does not become more toxic on aging. According to DeLaureat, if 2 ounces of a 2 per cent solution were swallowed, no more serious consequences than a sore mouth and diarrhea would

result. This consideration is of some consequences around small children.

Dressing. Sterile gauze squares are the ideal dressing material. For small cuts, a good dressing can be purchased ready-made, consisting of a strip of adhesive to which a small piece of gauze is attached. It is bad practice to apply adhesive directly over a wound, as this seals in anaerobic bacteria, such as the tetanus bacillus, prevents drainage, and is painful to remove. For the same reason, liquid collodion should never be used directly on a wound.

Lockjaw (Tetanus Prophylaxis). Any wound received on the playground, street, or field-hike, is a potential source of lockjaw. The child's doctor should be consulted as to the advisability of tetanus antitoxin. This is imperative in puncture wounds, because they are difficult to clean even with specialized instruments.

III. Burns

Fire. The first requisite in the first aid treatment of minor burns suffered by children is to alleviate pain. This is accomplished to some extent by application of a paste of baking soda in water, any good burn ointment, plain or carbolated vaseline, any clean oily substance, or cold water. Severe burns characterized by blistering or breaking of the skin should be treated by a physician as infection is imminent. Never apply iodine to a burn. Do not use an ointment on extensive severe burns as a first aid measure, as this interferes with the treatment used by some physicians. For such extensive burns cover the individual with sterile gauze (or a clean cloth) soaked in *one* of the following solutions.

1 teaspoon table salt to a pint of warm water
1 teaspoon Epsom salt to a pint of warm water
1 teaspoon baking soda to a pint of warm water

The measurements need not be exact. The dressings should be kept moist and warm until medical aid is obtained.

Hot Water. The first aid for scalds is the same as that described above.

Acid. Immediately flush the area with running water until a weak alkali can be procured to neutralize the acid. Soda bicarbonate is the best alkali to use. Do not use lye or strong ammonia as this will cause further damage to surrounding tissue and will neutralize no better than soda.

Alkali (*Lye*). Immediately flush with water as above, but use vinegar as a neutralizing agent. Do not use a strong acid.

Carbolic Acid (*Phenol*). This is not a true acid and is neutralized by rubbing alcohol in large quantities, not by soda. Flush with water before and after the alcohol. If phenol is freely taken internally, do not give alcohol, as this hastens the absorption of phenol into the circulation.

Electricity. Many children have at some time received an electric shock from probing a light socket with a metal object or their fingers. Such burns may appear inconsequential on the surface, but are sometimes deep and extensive, as one type of current destroys tissue as it passes through. The other type of current causes severe shock, but rarely severe burns. Electric shock should be an indication for immediate artificial respiration until a physician arrives. One must also remember the danger of touching a person still in contact with an electric current. Always use a non-conductor, such as wood (dry) or heavy rubber, as an implement to remove the victim from the source of the current.

Sunburn. This condition can be more serious than usually realized. It is advisable to dismiss a child with a severe sunburn from school, as children usually consider it a good joke to slap the victim on the back. Any good burn ointment should be used as a first aid remedy. As a prophylaxis, olive oil, applied freely to the skin, will prevent severe burns from developing.

IV. Foreign Bodies

Particles in the Eye. Children frequently get particles of dirt or debris into the eye while playing on the school grounds. In order to remove the particle, the upper lid of the eye should be grasped by the lashes, and pulled out and down, so as to overlap slightly the lower lid, and held this way for several seconds. This causes considerable lacrymation which tends to wash the particle to the inside corner. Several drops of mineral oil or olive oil in the eye will help to dislodge the foreign body and lessen the irritation. There are many old remedies for a mote in the eye, but they are all based upon the three reliable principles: keep the eye closed, do not wink or rub the eye, and provide something to occupy the child's attention while the tears have an opportunity to form and float the particle to an innocuous location.

Obviously, the only certain method for dealing with such a

situation is to visualize the particle and brush it out with the tip of a cotton applicator, preferably moistened with boric acid. If, however, the particle is firmly attached to the transparent portion of the eye, it would be wiser to seek a physician's services at once as unskilled attempts at removal can lead to serious infection or perforation.

In order to inspect the eye carefully, first pull the lower lid down and have the child look upward as you search the inside of the lower lid. If not seen there, evert the upper lid. This is easily done by having the child look downwards, then pull the upper lid down and out by the lashes and place a match or tooth pick on the upper lid about one fourth inch from the margin and press in gently with this stick with one hand, while you gently turn the lid over the stick with the other hand. Any particle here is thus made readily accessible.

Chemical Burns of the Eye. Any acid or alkali splashed into the eye should immediately be washed out with large quantities of water. A drinking fountain may serve as an ideal means of flushing the eye. Too much water cannot be used. Then place a few drops of clean oil in each eye and apply a moist compress. A doctor should be summoned as soon as possible.

Foreign Bodies in the Stomach. This condition is likely to cause considerable apprehension on the part of the teacher, which will be communicated to the child, and create unnecessary excitement and fear. It is, however, not in the field of first aid treatment. Do not attempt to induce vomiting, as in most cases this will be more dangerous than natural passage. It is well to consult a physician as soon as practicable.

V. Fractures and Sprains

Important Suggestions. The first aid treatment for fractures and sprains is a comprehensive subject and only the general principles can be mentioned here. If in doubt about the injury it is safest to assume a fracture is present until proven otherwise so it is best not to move the child until a splint has been applied. This is to prevent further damage as the broken ends are very sharp. Should a bone be protruding through the skin, it should *not* be touched. Beware of swelling, blueness, coldness, and increasing pain in the hand or foot of a splinted extremity. This means the circulation is dangerously impaired, and the splint should be loosened.

Splints can be made from any firm material, and should be

padded on the side next to the body. They should be long enough to extend beyond the joints on each side of the fracture, but remember, splints are only to secure immobilization of the broken bone until the patient can be taken to a doctor.

The Sprained Ankle. It is sometimes impossible, without an X-ray to differentiate a sprain from a fracture. In fact, they often occur together. In school children, however, fractures of the ankle are very rare.

No weight should be borne on the ankle. The leg should be elevated on a pillow, as dependency increases the swelling and pain. Apply cold packs or ice packs until seen by a physician.

VI. Bites and Scratches

Bites. These are usually inflicted by dogs or cats. Naturally, hydrophobia is always to be feared in such cases. It is important to identify the offending animal, so that it can be watched for the development of rabies. First aid treatment of the bite is the same as for any small open wound. However, it is imperative that such cases be seen by a physician. Bites from other pets are dangerous in that they may cause severe infection and also transmit certain diseases. Rat bites are especially to be feared. The human bite frequently causes the most necrotizing wounds seen. Do not fail to clean these as thoroughly as possible.

Scratches. These are usually dangerous only in that they may cause infection and blood poisoning. If the animal is rabid, the scratches are dangerous from that standpoint, as the claws are likely to be contaminated with saliva which transmits the virus of hydrophobia.

Snake Bites. Here is the situation in which a tourniquet in some form is indispensable. Apply it only tight enough to occlude venous return and thus increase the bleeding. Never leave on longer than one hour at a time. Rather deep incisions ($\frac{1}{4}$ inch) should be made with a sharp knife, or razor blade around the bite. Suction should be applied for an hour or so, until medical aid is obtained. This will, of necessity, usually be by the mouth. Do not give whiskey, as it may do more harm than good. Bring the patient to a doctor as soon as possible. If a field trip is contemplated into inaccessible regions, a snake-bite First Aid Kit and directions should be taken along.

Bee Stings. The pain is best relieved by applying a paste of soda and water or a compress soaked in weak ammonia water to the area. The "stinger" should be pulled out promptly. Cold compresses lessen the pain and swelling.

Spider Bites. In the United States the only authentic cases of arachnidism have been due to the bite of the Black Widow (Latrodectus mactans). It is also called shoe-button, hour-glass, and T-dot Spider. The bite stings for a few moments and then subsides. In 15 to 30 minutes pain reappears at the site of the bite and spreads all over the body. There is considerable painful muscle spasm, and often spasmodic twitching of muscles. The bite itself may hardly be visible, and is not particularly tender. If the bite is noticed at the moment of its infliction, it would be wise to employ the same methods as used in poisonous snake bites. Apply a tourniquet at once, between the bite and the heart. Make several radially placed incisions at the site of the bite. These should be $\frac{1}{8}$ to $\frac{1}{4}$ inch in depth, so as to bleed freely. Suck the wound thus made, trying not to swallow the blood. This will remove some of the poison and lessen the severity of the illness. If, however, symptoms of generalized pain have already begun, hot baths or soaks will ease them some. Opiates will have to be administered as soon as a doctor can be reached. Bites from other spiders are best treated by applying a compress soaked in warm Epsom salt solution, made by adding a tablespoon of salts to one pint of water.

Chiggers. This is an infestation with a small mite, which burrows under the skin and causes intense itching. They are often contracted on field trips in summer. Treatment is purely symptomatic, until medical consultation is obtained. Calamine Lotion Compound is the safest and most effective first aid remedy to alleviate the itching.

VII. Miscellaneous

Nosebleed. This is probably one of the most common emergencies and one which usually is of little consequence, although it causes considerable apprehension. The first principle is to remain quiet. It is better to sit up, as a horizontal position increases the blood pressure slightly, at the site of the hemorrhage and hinders clotting. Have the child sit with his head thrown back, and breathe through his mouth. Discourage any snuffling or blowing of his nose. If the bleeding point is anterior, coagulation is facilitated by pinching the soft part of the nose tightly for 5 to 10 minutes. The insertion of a small pack of gauze or cotton, or tissue may help. However, this should be done gently, and it should be directed backwards, not upwards. The old remedy of placing ice on the back of the neck, perhaps, is of value only in that the patient is compelled to remain quiet to keep it in place.

In practically all cases of spontaneous nose-bleed, the hemorrhage will stop of its own accord in several minutes. If much difficulty is experienced, a physician should be consulted.

Convulsions. In cases of convulsions a physician should be summoned at once. In all probability, the seizure will have ceased in a few minutes, leaving the child in a dazed stupor. The teacher should never allow herself to become alarmed, but remain calm. Convulsions are almost never immediately dangerous per se. It is, however, her responsibility to see that the child is protected from pounding his head or chewing his tongue during the seizure. Do not forcibly restrain his movements, but protect him from striking himself on any firm object that would inflict bruises or cuts. A pencil wrapped with a handkerchief is perhaps the most readily available object to insert between the teeth to prevent chewing the tongue.

Water Blisters. These are caused by some source of irritation. First take measures to remove that source. It is not necessary to open the blister as a first aid measure, unless inflamation is also present. In such case, the blister should be opened by a doctor, and the infection treated, as serious blood poisoning has resulted from seemingly insignificant blisters. If the blister has broken, treat it as a small open wound.

Blood Blisters. The same principles of treatment apply here. It is not necessary to open these to drain the blood as a first aid measure.

Sunstroke. This is caused by direct exposure to the sun's rays. It is characterized by a flushed face and hot dry skin. There is headache, dizziness, malaise, and sometimes vomiting. Unconsciousness will eventually occur. Treatment includes any method to cool the child. Remove him from the direct sun and bathe him with cool water. Keep cold, wet cloths on the forehead or an ice bag, or ice wrapped in cloth. Remember these are only first aid measures until a doctor can be contacted. Severe cases have been wrapped in a sheet, kept wet with cold water. There is always danger of cooling too much. Stop treatment every 30 minutes and observe the patient. If the skin remains hot and flushed, continue cooling procedures. If muscle cramps occur, these may be relieved by taking salt tablets.

Head Injuries. Such a term is used by the medical profession to indicate those injuries in which there is a possibility of injury to the brain. Children, invariably, are receiving bumps on the

head from time to time, which cause swelling, pain, and tenderness. These require no treatment, usually. However, when a person is knocked unconscious, he has received some brain injury. Often by the time the doctor arrives, consciousness has been regained, and there appears to be nothing to fear. Yet the patient may lapse into coma again within an hour or two. This must be considered as indicating immediate hospitalization. Any person who has been "knocked out" from a blow on the head must be under medical observation for at least 24 hours, preferably in a hospital.

The Black Eye. This is not a very severe injury, and calls for no alarm. The use of compresses, kept moist with cold water only, is the ideal treatment. The traditional beefsteak is not necessary.

Frostbite. Fingers, toes, and ears are most frequently affected. Occasionally the nose and cheeks may be frost bitten without producing much pain. This is a condition in which ice crystals are actually formed in the tissues. Contrary to most belief, such tissue should not be rubbed with snow. It is possible for ears to become frozen so stiff that pieces will break off if rubbed briskly. The best treatment is to heat the frozen area slowly, by holding the ears or nose or cheeks with the hands. Above all, do not apply hot water or radiant heat to frozen parts, as they will crack open, cause serious trouble, and probable gangrene.

In conclusion it is well to bear in mind that the suggestions given for first aid treatment are only temporary measures. For all injuries the child should always be kept in the most comfortable and calm situation while the services of a physician are being secured. Some schools are fortunate in having a doctor or nurse on the premises while others must depend on outside aid. The best rule for all situations is to keep these suggestions in mind and use common sense.

An educational program for common defense must in practical ways both increase our skills and enlighten our understandings for the pursuit of common democratic purposes. If we can see that during the last four years the democratic peoples have become the victims of their own ignorance—their ignorance of the ways of dictatorship and their ignorance of the ways and means of making democracy work, nationally and internationally—then we must see that education carries a major responsibility for the ultimate victory of free government.—*John W. Studebaker, U. S. Commissioner of Education, Atlantic City address,* February 24, 1941.

PRACTICAL MATHEMATICS*

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The history of mathematics is one of finding easy, accurate and reasonable ways of solving problems. This organization is working for that same reason. The reasons for teaching mathematics are that it is practical, disciplinary and cultural. The disciplinary and cultural values may be questioned, but the practicability cannot be doubted. It has developed mainly with its applications. Physical science and mathematics developed together. There had not been very much development in mathematics until the times of Galileo and Newton. Neither had there been any noteworthy advancements in physics. The real development of modern physical science and modern mathematics began with the works of these men, which is probably no coincidence as development in the science required developments in mathematics existing at that time. One of our greatest modern-day scientists, namely, Albert Einstein, is also one of our greatest modern mathematicians. The science of astronomy has had mathematics for its foundation. The average person does not think of the important part that mathematics plays. He does not realize that the time of an eclipse, which is predicted to a fraction of a second, is based on mathematics. Also, the action of the tides is predicted entirely on its application. In my estimation, one of the most remarkable incidents of science was the figuring of Neptune into existence. Its size, location and movements were all figured out before the planet had been found. A modern, practical application of astronomy and mathematics is the workings of the planetariums which we have today. They are marvels of mathematical precision and mechanical applications, and no chance of visiting any one of these should ever be neglected by anyone. Today, engineering, science, industry, agriculture and even business administration owe very much of their development to mathematics.

One of the world's greatest practical mathematicians and scientists was the late Charles P. Steinmetz, who worked for the General Electric Company. Before his time, alternating current was not practical because its application was too complicated for practical use. By means of practical applications of

* (Delivered at the Mathematics Section, Kansas Teachers' Association, Wichita, Kansas, on November 2, 1940.)

mathematics he was able to make alternating current practical, which fact is demonstrated in our everyday life. The science of economics is making use of mathematics to a certain extent, and it is proposed that it be used still further, mainly, in connection with our monetary values. It has been said that our silver dollar was made with the inscription "In God We Trust," but today it, in reality, means "I Hope That My Redeemer Liveth." In order to correct this situation it is proposed that monetary values be based on index numbers, which should be computed by algebraic formulae from commodity price statistics. This is one of the views which probably has some merit and it is very probable that many more can and will be developed. Insurance annuities and taxation depend to a very large extent on mathematical applications.

The citizen today has urgent need for at least a meager understanding of mathematics. With our Social Security Plan, each citizen should be able to figure out its application on unemployment insurance, old age pension, etc. Income tax reports require about the same knowledge. The use of intelligence tests expressed in terms of the "I.Q.," is becoming more important both socially and vocationally. Bacteriology, as applied to public health, comes in for its share of mathematical applications. Even drunkenness can now be definitely determined by scientific tests and mathematical applications. It even takes somewhat of a mathematician to talk intelligently about our National debt.

I would like to mention some of the defects I have noticed while teaching mathematics and also in its industrial applications, and will suggest remedies for whatever value they may have. The one cause of greatest trouble in my estimation is inability to understand English. That is not peculiar to mathematics alone. The remedy would be a closer correlation of mathematics and English, stressing problem analysis and pointing out specific defects. Another cause of trouble is lack of approach to solving a problem. In the majority of cases there is no system or orderliness. The reason which probably receives too much credit for trouble in mathematics is forgetting. As in everything else, this has its place. As we know, use stimulates memory. On the other hand, psychologists say that recall depends on a thorough understanding of the process—not just a knowledge of routine, on similarities standing out more than differences, and on new processes being learned in terms of old familiar ones.

In regard to the first reason as given, I would like to state some experience along that line. In our work we give an examination to high school graduates who are applying for work in our laboratory. We make it a point to choose only the applicants who have a comparatively high I.Q. and have had physics and chemistry. The following problem in this examination illustrates my point—"The following are units of measurement: inch, volt, acre, calorie, sq. ft., gram, centimeter, pound, candle-power, cu. ft., ampere, cubic centimeter and horsepower. Name two units of (a) length, (b) area, (c) volume, (d) weight." The correct answer to this problem is an exception rather than the rule which shows that the majority of the better high school graduates are unable to clearly distinguish the difference between linear measurement, area, volume, power, etc. This probably accounts for very much of the forgetting because the ideas were never thoroughly learned in the first place.

In my own experience I can recall many examples in which I have been able to remember facts and principles on account of their having been taught as similar to something else. As an example, students are taught that 231 cubic inches make a gallon. The fact that 2.31 feet of water-head make one pound static pressure is much easier to remember if the fact is mentioned that the same figures are used here as in the former. From my observation, it seems that area, volume and lateral surface of geometrical figures could be figured and remembered much easier if each were taught as being measured by the same general method rather than stating a specific rule for each specific figure.

It seems that a great deal of teaching could be simplified by teaching new processes in terms of old familiar ones. I am thinking particularly of fractions. Fractions are encountered by most students as an entirely new process, having no relation to anything that has been taught before. This is true in arithmetic and again in algebra. The teaching of fractions could well start with the teaching of division. The conventional way of expressing division as 12 divided by 2 could also be expressed at that very time as a fraction, that is, 12 over 2. This would teach that a fraction is nothing more than an expression of division. It could be elaborated further to show that that number can be simplified but in the case of 1 divided by 2, since 2 cannot be taken into 1, 1 over 2 is the simplest way of expressing it. A step farther at the same time would be an approach to the same subject in

algebra, such as, A divided by B could be expressed the same as A over B. In division we think of dividend and divisor, while these terms could also be shown to be the same as numerator and denominator. Another help in this direction would be the spending of a little more time on addition, especially addition of mixtures. Students readily learn to add units of the same measurement, but when they have mixtures, it is a little different proposition. For example, one number of apples plus another number of apples will give a definite number of apples. Likewise, two groups of apples and pears and oranges will give a definite number of apples, pears and oranges. That is, one of these articles cannot be expressed in terms of the other. They could then be expressed as abbreviations or symbols and add them as before. This would help to clarify addition in arithmetic and would also be one of the first steps in algebra. Likewise, in multiplication, 3 times 3 times 3 equals 27, but at the same time it should be taught that the answer might be expressed as 3 cubed. Then elaborate it a little further and show that any symbol which would take the place of 3, such as "A", would be used in the same way, that is, $A \times A \times A$ equals A cubed, not $3A$, any more than $3 \times 3 \times 3$ equals 9.

One of the other weaknesses I have noticed has been inability to check results. It seems that students are not properly impressed that they are working for a correct solution, rather than just an answer. They should be taught that everybody makes mistakes but the better the student is, the less mistakes he makes, and going a little farther, the better the student is, the more of his own mistakes he will find. It should also be impressed that in commercial or industrial work that there are no answer books and that the answers must be correct. A great many check methods are taught, and we have some problems which are rather hard to check, but in every instance there is some way of doing it, and the greater the ingenuity of the student, the better he will check his results. This process is a direct development of the three principles of recall as just mentioned; namely thorough understanding, making maximum use of similarities, and teaching new processes in terms of old. All check methods do not have to be exact, as approximate methods can be used to very good advantage in some cases. The rule of reason should also enter in different processes as most problems have reasonable answers. This, however, requires some practical knowledge of the subject which will limit it to some extent, but it should be used wherever

possible. This brings to mind another method that may be used by the better students, which tends to popularize mathematics with them and also helps to use the extra time they may have while the teacher is taking care of the slower students—that is the use of the slide rule. While the working principle of the slide rule is based on the theory of logarithms, it is not necessary for the student to have had logarithms to use a slide rule. As most teachers probably know, it requires very little instruction for a good student to learn to use a slide rule for multiplication and division. Its use also gives valuable instruction in the science of numbers.

Another defect of many high school graduates is their inability to use decimals and percentages. Students are taught the use of common fractions first, and then decimals. It has been my experience that the students always dislike to use decimal fractions because they are more or less familiar with common fractions and, for that reason, will slight decimals. Another thing that contributes to this is the use of common fractions in most of our English systems of measurement. I believe that the two could be taught simultaneously to a very large extent, at least to the extent that decimal fractions will not be a surprise to a student. In this teaching, the conversion of one form into the other should be continually stressed and used. Also, as in all other cases, show the advantages of decimals. Our best example in common use is our money system, and a student can soon be shown how much easier it is to solve problems involving money than it is to solve them involving rods, yards, feet and inches. Another help would be to introduce the metric system at this point. Mention some of its common uses today where people are using it and do not realize its advantages, as in our money measurement, radio measurements, photography, and practically all scientific study. Another suggestion would be to develop the decimals naturally into percentage. In our high school technical examination, which was referred to earlier, we have the following problem: "25 cc of alcohol are mixed with 100 cc of water. What percent of the mixture is alcohol?" Most answers to this problem are given as 25 percent. Just a little reasoning would show that this answer is wrong, as was mentioned before in using common sense to check results. Another problem in the same examination along this line which is generally missed is the following: "In running a carbon residue test, 10 grams of oil are burned, leaving .015 gram coke or carbon residue. What percent

of the oil is carbon residue?" The wrong method is used about as often as the answer is expressed wrong when worked by the right method.

One of the common mistakes seems to be that of using the same decimal for percent as would be used for the fraction itself, or the inability to express percent when either integral or fractional. In other words, it shows that there has been no thorough understanding of the subject.

One of the other weaknesses is the inability to understand and use formulae. Since a formula is nothing more than an abbreviated rule, it seems that they should be taught that way and that they should be remembered in the same way, rather than to remember them as a purely mathematical formula. One other suggestion in this line is to use reasoning in solving a problem rather than using formulae needlessly. Another noticeable defect is the inability of a student to find information. In my estimation that goes back directly to our more or less stereotyped methods of teaching. Students too often think that the only source of mathematical information is their textbook, and that it should be memorized, if he is to be a good student. I believe that the use of hand-books and other reference books should be developed at the first opportunity. It is true that there may not be any appropriate ones for some of the purposes of this kind but the development of one would make a good project for some teacher. This would be a step toward teaching mathematics as it will be used in after life. Any teacher who has experienced taking an examination while in school, in which he was allowed the use of textbooks, can realize the freedom and privilege that was enjoyed. Even though it may not mean a whole lot fundamentally, it certainly relieves strain and is also a step in the right direction. This does not mean that students should not memorize anything, but it does mean that they should rely more on ability to find useful information than to remember all of it.

From the industrial standpoint, it is lamentable that mathematical requirements are often inappropriate and unreasonable. For example, a marine or stationary steam engineer is supposed to pass an examination in mathematics which prepares him more for designing an engine rather than operating one. There is a standard problem known as the safety valve problem. It is a good problem in physics on the application of levers, but for a steam engineer it means nothing. In the first place, it refers to

an obsolete type of equipment, which has not been used for forty years, and in the second place, when it was in use there were graduation marks to be used rather than having to resort to any complicated mathematical calculation. Another problem generally asked is how thick the boiler plate should be and what the size and spacing of the stay bolts should be in a boiler of a certain size designed for a specific pressure. It can plainly be seen that these are the problems which a practical operating man has no use for whatever and generally has no training to solve them. It sometimes eliminates good men and in all cases it requires them to spend a lot of time which could be used to better advantage. Some such requirements are often political, as we have all heard of a certain state legislature attempting to assign the value of pi an integral number to simplify its use.

My suggestion for mathematical courses, based on past experience in teaching and industrial work, would be to give a general mathematics course following the fundamentals of arithmetic. This course should be designed as the final mathematics course of most students. It would be nothing more than applied arithmetic and an approach to algebra, geometry and physics. The average student is never going to have any use for algebra as such. The course should include fundamentals on measurements, density, specific gravity, work, power, simple machines, speed of pulleys, Ohm's Law, and other simple and practical physical principles. The higher mathematics courses should follow this course in general mathematics and would include algebra and geometry. The general course would require considerable time, but the time required for the higher mathematics would also be cut down because the student should have a much better foundation and should make faster progress. Only those with ability and desire should take the higher mathematics. This should be properly explained to all students so that the courses might not be either overlooked or taken needlessly Reasons for taking the higher mathematics would be for its application or requirement or as a favorite subject.

Another thing that should be stressed in high school, as well as in the grades, is vocational training, and this does not apply only to mathematics teachers but should be practiced by all. From the very first, students should be directed according to ability and inclination. Every opportunity should be used by mathematics teachers to advise and recommend proper mathematical courses. This can be done in discussion and when certain

mathematical principles suggest further use in advanced courses.

Along this line students should be encouraged and directed at all times to get along with each other. It is estimated by authorities that 65 percent of the people who are discharged from jobs are done so on account of inability to get along with their fellow workmen or supervisors, while only 35 percent are discharged for lack of technical knowledge. Another reason for teaching vocational training is the fact that reliable sources estimate that 80 percent of the working people are misplaced. The tendency is for a student to take the path of least resistance. that is, they seek a job of whatever is available and too often get so far along with whatever it is that it is practically impossible to make a change. This condition should be improved and undoubtedly could be by the proper vocational training starting at the earliest possible age of the student.

Another improvement which could be made in teaching would be the use of improved textbooks. Most of the testbooks used at present were devised for use with a teacher's help. They fail to give enough clear instruction for a student, even the brighter ones, to go ahead on a new process without a teacher's explanation. A great improvement along this line is the kind of textbooks used today for vocational, correspondence, and self-instruction. Textbooks of the proper kind would enable the better students to utilize their ability to go ahead without depending so much on a teacher. It would in turn give the teacher more time for the slower students. Free use should also be made of sketches, diagrams, and even simple blueprints in mathematics textbooks.

I believe that one of the greatest improvements that could be made in the teaching of fundamental mathematics would be the use of the laboratory method wherever possible. It would require very little equipment and would make use of real problems. Some of the problems or projects that I readily think of are reading meters and figuring utility bills, shingling a building, painting a building, papering a room, figuring the capacity of a bin, number of tons of hay in a stack, various shop problems, ordering material, figuring freight, express and parcel post, and teaching the use of the slide rule. These problems or projects could be used to a large extent according to the student's ability, inclination, and vocational interest. This method would show the need of mathematics and provide an incentive which is one of the greatest needs.

Another suggestion would be to teach ordinary reasoning first, which has already been referred to. An application of rules is more important than the ability to state the rules as even a parrot can state a rule.

Another helpful method, which has been used to some extent in teaching mathematics, is the use of mathematical recreations. They require original thought and would tend to teach the right approach to solving all problems. This method has been tried out in three high schools in Pennsylvania. In each one of these schools two classes of equal ability were used. One used the conventional method while the other devoted one class period per week to the use of mathematical recreations. The recreations were of such a type that students could have fun while using them. No attempt was made to agree on the particular recreations to be used, but close agreement was found on the methods used. All three used recreations of the contest type ranging from the spelling bee to the solution of regular textbook problems on the board. Examples of books used were *Mathematic Wrinkles*, *Mathematical Nuts*, *Mathematical Recreations and Essays*. The results showed that the use of recreations gave advantage in both achievement and attitude. For further information on this particular project, I refer you to "The Effect of Recreations in the Teaching of Mathematics" in the *School Review* for June, 1938.

HIGH SCHOOL PHYSICS FOR GENERAL EDUCATION*

Report of the Committee on Physics Teaching Central Association of Science and Mathematics Teachers

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Mr. Chairman and Members of the Physics Section—Let me quote from the minutes of last year's meeting: "Physics teachers as a whole have felt that something should be done to revitalize the subject of physics in order to meet the needs of youth today in general education. Therefore a motion was made and seconded that an Educational Committee be appointed to study this

* Presented to the Physics Section, November 22, 1940, Cleveland, Ohio.

problem. The chairman of the Physics Section appointed Dr. Glen W. Warner as Chairman of this committee and power was given to him to select his co-workers."

Since last year through the cooperation of Professors Harvey B. Lemon and Ralph W. Tyler of the University of Chicago the interest of the General Education Board was secured. Scholarships were provided for five active high school teachers of physics to enable them to carry out the investigation. The following were selected:

Louis D. Allen, Arsenal Technical High School, Indianapolis, Ind.
Carl A. Benz, Hammond High School, Hammond, Ind.
John L. Clark, Chapman Technical High School, New London, Conn.
J. W. Moelk, Parker High School, Chicago, Ill.
Kenneth E. Vordenberg, Washington Junior High School, Cincinnati, O.

Professor Tyler then made available for this study the facilities of the University of Chicago Workshop in General Education for the five week period from July 22 to August 23. Professor R. J. Stephenson of the Physics Department, University of Chicago, Dr. Glen W. Warner and the five teachers carried out the study.

May I quote some statistics from a study "Offerings and Registrations in High School Subjects" 1934, U. S. Office of Education Bulletin 1938, No. 6., Carl A. Jessen.

		Students taking Physics	*% of Enrollment*
1900		98,846	19.04
1905		106,430	15.66
1910		107,988	14.61
1915		165,854	14.23
1922		192,380	8.93
1928		198,402	6.85
1934		281,928	6.27
1934	Chemistry	339,767	7.56%

In 1934 there were 23,213 high schools in the U. S. Only 17,632 of them reported in this survey. Even though the numbers of students taking physics has steadily increased the percentage of the total enrollment has steadily decreased. In 1938 over 5,000,000 boys and girls were enrolled in the entire United States in high schools.

With the above figures literally staring us in the face, this committee met in Chicago to discuss the problem and suggest some remedy. A preliminary discussion revealed general agreement that about twenty percent of the high school students profit from the present physics courses, and that a majority of

the remaining eighty percent could get enjoyment and profit from a physics course suitably organized and effectively presented. It was therefore agreed to outline a course of study for this majority group and to suggest aids for its presentation.

The following *General Objectives* were set up:

A. *General Education of the Public*

a. teachers
b. parents
c. pupils

Radio talks, popular stories in magazines and newspapers, lectures and demonstrations, science club activities, etc., to acquaint the public with the practical applications of physics. A wealth of material in some fields but a lack in the field of physics.

B. *Teacher Training Programs*

The educational training of teachers of physics needs strengthening.
Many teachers are asked to teach physics without adequate preparation

C. *Physics Curriculum Needs*

Revision.

D. *Encouragement For Students to Study Physics in Higher Education*

Scholarships, essay contests, tests, etc.

It was felt that the work of the committee would deal with a revision of the Physics Curriculum to make it more useful and interesting, and to satisfy the requirements of the large group of students who finish their education with the completion of high school. Work in fields A, B, and D would be done later.

Objectives

To give the student an understanding and appreciation of those fundamental concepts which are the foundation of the science of physics.

To enrich the student's understanding and appreciation of these concepts by numerous applications from his everyday life and from industry.

To present the subject matter to the student in such a manner that it will establish habits of reflective thinking and promote the use of the scientific method of solving everyday problems.

To show clearly to the student the method which science uses to obtain knowledge and how evidence and assumptions are used in building theories.

An attempt was made to analyze the difficulties of students and the following conclusions were reached:

The concepts themselves are difficult.
Analysis is a difficult process.
The vocabulary used to express the concepts is extensive.
The mathematical formulation of the concepts and the symbols used are new to high school students.
The units used in these mathematical formulations are numerous, and confusing. Two systems of measurement add to the difficulties.

For general education a working understanding of a limited

number of the basic concepts of physics is of more importance than exact numerical answers to many individual and seemingly unrelated problems. Hence it is proposed to center attention on fewer concepts and required new words than are included in the orthodox course; to place very strong emphasis on the use of these concepts in life situations; and to resort to mathematical symbolism and numerical results only when these devices give definite advantages. The teacher was cautioned to remember that he is teaching pupils and not subject matter.

To facilitate progress the problem was divided into three parts and workers assigned to each part.

Part 1. An outline of the subject matter topics to be included and sample presentations prepared. The enumerated objectives, difficulties, and plan of approach served as criteria. Messrs. Clark, Stephenson, and Warner were assigned to this work.

Part 2. An assembly of lists of all types of aids for the teacher for presenting the course. This listing was to be annotated with recommendations as to where each type of material fitted into the course to best advantage. Included are demonstration experiments, laboratory experiments, books, periodicals, booklets, bulletin board materials, films and film slides, slides, charts, pictures, models, exhibits, suggested types of trips, pupil reports, science club materials, plays and auditorium programs, radio program suggestions and suggestions for presenting the concepts of physics to the general public. Messrs. Vordenberg and Benz are carrying out this study.

Part 3. A preparation of questions, problems and test exercises designed to promote realization of the aims and to test accomplishment. This was assigned to Messrs. Allen and Moelk.

At frequent intervals the entire group assembled to confer and criticize the work. Many conferences were held by the group and by individual members with staff members of the General Education Workshop.

At the close of the period of the Workshop, August 23, a tentative outline of the course was ready and sample presentations were in rough form in the topics Linear Motion and Acceleration, Inertia and Motion, Vectors and Vector Addition. A rather extensive list of aids covering the Mechanics outline was complete. Questions and test material for all purposes covering the major topic Mechanics were completed.

During the school year 1940–41 this work is being continued and tested out in practical classroom conditions in the various schools represented by the group. It is the hope of each member of the Committee that further study can be given to the work and that it can be successfully carried to completion. It is the

desire of the group to see the subject of physics presented in clear, concise language within the range of the pupil's previous experiences: to give the student a background of physics to understand and appreciate his environment. Discussions should be supported by many simple drawings. Laboratory work should be suitably motivated, simplified apparatus should be used and great accuracy should not be expected. Home experimentation is to be sought and encouraged; demonstration experiments with large equipment should be provided; films, slides, charts, models, and other types of visual aids should be used. Objective tests and exercises will test the desired accomplishment of our aims of the course. May we hope that physics may again take its place in the high school through its usefulness in the everyday life of the student body of American Youth.

The committee wishes to extend its sincere thanks to Professor Ralph Tyler for the excellent facilities provided and personal advice given; to Dr. R. J. Havighurst of the General Education Board for the financial aid given for the work and for his own personal aid; to the staff members of the Workshop; to Dr. Glen W. Warner for his encouragement and helpful advice; to Dr. Stephenson, Dr. Klopstake, Dr. Le Sourd, Dr. Heil, Miss Ernestine Long, Dr. Holley and many participants of the Workshop whom we consulted.

The full membership of the Committee on Physics Teaching is Louis D. Allen, Carl A. Benz, John L. Clark, J. W. Moelk, Kenneth E. Vordenberg, R. J. Stephenson, Ray Lambert, Raymond Agren and Glen W. Warner, Chairman.

As a summary may we point out that we propose that fewer concepts be taught with a working understanding of them; a smaller vocabulary; the use of concepts in life situations; mathematical symbolism only where it gives definite advantages; a wealth of teaching aids; increased pupil activity through simplified experiences at school and suggested activities at home; and through pupil demonstrations and club activities. Popular public lectures and demonstrations, more interesting room conditions and surroundings and an interesting set of study aids for pupil self testing of work accomplished will greatly aid the development of the course of study for physics teaching that we hope to attain.

A distribution on a large scale for try-out work in the country as a whole is to be desired. We invite correspondence, assistance and criticism of our undertaking.

FINDINGS IN THE TEACHING OF BIOLOGY*

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In the spring of 1936, a questionnaire pertaining to the syllabus in and methodology of biology was distributed to high school pupils who were studying biology. The pupils were asked to be sincere in replying to these questions; their classroom teacher did not see the responses and the students were so informed. The questionnaire was administered by the writer to the biology classes of the Theodore Roosevelt, Evander Childs, and Morris High Schools in the Bronx, New York City. The following is the first report which attempts to evaluate the results.

Of the 1167 papers, 164 were those of Morris High School, 574 of Evander Childs, and 429 of Theodore Roosevelt. The first question was: "*Place a check next to the topic listed below which you found most interesting. Place a cross next to the topic listed below which you found least interesting.*"

Invertebrates	Protozoa	Insects
Birds	Fishes	Metazoa
Man (Structure & Function)	Reptiles	Vertebrates
Spirogyra	Mammals	Amphibians
Yeasts and molds	Fungi	Bacteria
Sponges	Vitamins	Mushrooms
Amitosis	Hydra	Mitosis
Plant reproduction	Heredity	Evolution
Protoplasm and the cell	Nutrition	Animal reproduction
Thallophytes (seaweed)	Pteridophytes (ferns)	Root, stem, leaf
Spermatophytes (trees)	Parasitism	Bryophytes (moss)

The following are the largest and most significant figures that represent percentages of pupils who found these topics most interesting.

Topic	Morris H. S.	Evander Childs H. S.	Roosevelt H. S.	Average
Evolution	19.6	29.6	18.8	22.66
Man (struc. & function)	24.1	24.7	36.5	28.43
Heredity	38.4	24.7	21.0	28.0

* The value of this work lies in showing what could be done in other school centers to study student interest but is too limited to permit generalization for high schools as a whole.—J. E. Potzger.

The other thirty topics did not receive as much as five per cent, in most cases less than one per cent, as the most interesting topic.

Yeasts and molds was voted as the least interesting topic by 10.5% of Morris High School, 15.9% of Evander Childs, and 21% of Theodore Roosevelt High School. The remaining topics were also voted as least interesting; however, the percentages are not significant. After studying this data one observes that about seventy-five per cent of the 1167 students will find one of the following three topics most interesting: Man (structure and function), Heredity, and Evolution. It seems fitting therefore, to construct a syllabus that would center around one or all of these three topics, since these are the major fields of pupil interest in biology. It suggests a revision of the biology syllabus which might be based upon man's overt behavior and adjustment, upon evolution and heredity. It, furthermore, suggests that we must find a new method of integrating the principles of biology with pupil interests, in order that teaching science may be a "way of life."

It is interesting to compare former Associate Superintendent Tildsley's report[1] of how pupils taking advanced biology in the New York City schools felt as to topical value, with those of the writer's report. The number of pupils is indicated as to what they got most out of:

Human physiology	2586
Heredity	2161
Evolution	1756
Eugenics	1581
Nervous system	1505
Reproduction	1362
Bacteriology	1149
Study of cell	1023
Nutrition	794
Civic hygiene	736
Biographies	679

Professor Frederick L. Fitzpatrick of Teachers College, Columbia University, in his interest findings in biology also concurs with both of these reports. Professor Charles J. Pieper of the School of Education of New York University maintains that a biology course should consist of problems based upon man's overt behavior.

Educators maintain that pupil interests should be considered in preparing and teaching a given syllabus. While some educa-

[1] J. L. Tildsley, "Teaching Science As a Way of Life," *Bulletin of High Points* (October, 1928).

tors will disagree with this statement, others will go further in stating that a syllabus should be based upon and centered around each pupil's interest. It is the writer's contention that we cannot effectively teach unless there is some native interest and it becomes necessary to create and stimulate further interest. Hunter[2] states:

"It is evident that, as native interests in animate or inanimate nature can be utilized, much can be done toward the organization of subject matter which will be taken over whole-heartedly by the pupil. The idea of the units developed in science courses is sound because this organization is built around the native interests of the children. Science study must be made practical to be interesting to young people."

Artificial stimulation very often misleads teachers in believing that students have a native or genuine interest in a selected topic. Anatomical, physiological, economic, and ecological detail should be utilized only when it yields *evidence* for the support of fundamental, vital principles of biology that can be applied to important problems of better living.[3] And above all, let us utilize student interest in teaching them to solve biological problems.

Pupils responded to the question: "*Would you prefer your assignments to be printed or stated orally by your teacher?" The following table gives the results in percentages.*

Assignment	Morris H. S.	Evander Childs H. S.	Roosevelt H. S.	Average
PRINTED	67	66	57	63
ORALLY	33	34	43	37

Printed assignments are favored over oral explanations. The nature of a classroom assignment is by far a complex issue to discuss adequately in this brief paper. An assignment should be clear, definite, and must be understood by the pupils. It is not uncommon for students to obtain inadequate or poor results in solving their problems as a result of not understanding the nature of the assignment. Bossing[4] lists five properties of the assignment: (1) Define clearly and concisely the task to be done; (2) Anticipate special difficulties in the advance work, and suggest ways to overcome them; (3) Relate new tasks to work

[2] George W. Hunter, *Science Teaching*, American Book Company, 1934. P. 82.

[3] N. S. Washton, "An Effective Approach To Teaching Biology," *Junior College Journal*, 11: 151–154 (November 1940).

[4] N. L. Bossing, *Progressive Methods of Teaching in Secondary Schools*, Houghton Mifflin Company, 1935. Chapter VIII.

previously done; (4) motivate properly the work to be done; (5) make adequate provisions for individual differences. Yoakam[5] reports a study of the criteria of the assignment as given by eighteen writers of books on methods of teaching. The following ten qualities of an assignment most frequently mentioned are: definiteness, clearness, interest, stimulation, inspiration, exposition, preparation, direction, discrimination, and individualization.

Most of the recent books on methodology state that assignments should be made orally by the teacher with the aim of attaining these goals. Preference is given to oral assignments and no mention, little if any, is made of printed assignments. It seems on the basis of this investigation that students prefer printed assignments in about a two to one proportion. Therefore, teachers have not attained these qualities associated with the making of assignments. It is reasonable to assume that an oral assignment by an enthusiastic and inspiring teacher can do far more for the qualities of interest, stimulation, inspiration, and exposition than a printed one. Yet, when all of these characteristics are satisfied, definiteness, clearness, direction, and discrimination are lost or become inconspicuous and *students do not understand the nature of the assignment.*

It is for this reason that students prefer a printed assignment. If there is a lack of definiteness and clearness, a conflict is set up in the students. They are not quite sure what is the nature of their task. As a result, they may not perform the task at all or they may perform the task without any meaning, significance and understanding. Therefore, it is suggested that assignments be stated orally as well as be printed. The printed assignment should not merely state "read pages 356–365 and do questions 1–10." A printed assignment should offer a clear, definite, challenging problem of interest and vital significance to the students. Sub-problems or questions associated with the major problem should be included. Many references of reading assignments should be listed. Suggested activities or experiences should also be a part of the printed assignment. A set of achievement questions to be answered by the students upon completing their investigations and experiences should be an integral part of the printed assignment. From this point, the assignment can be stated orally by the teacher with a view of attaining those qualities of interest, stimulation, inspiration, exposition and dis-

[5] G. A. Yoakam, *The Improvement of the Assignment*, The Macmillan Company, 1932. Pp. 89–91.

crimination. Printed and orally, provisions should be made for individual student ability and interests in making assignments. A co-operative feeling on the part of the pupils and the teacher will contribute far more towards learning than a competitive plan.

Another question was: "*Would biology be made more interesting for you through visits to parks and by having outdoor biology classes?*" In the following table, the first column under each school represents the number of pupils who responded to this

	Morris H. S.		Evander Child H. S.		Roosevelt H. S.		Total-Average	
YES	157	95	536	92	402	93	1095	93
NO	7	5	45	8	27	7	79	7

question; the second column the per cent. Ninety-three per cent of more than one thousand pupils would welcome the opportunity of learning biology through *doing*, living, and experiencing the "way of life." The writer had the opportunity of directing the activities of a biology class in the woods in back of a high school during class hours. The environment, prolific with living things, was in itself a motivating force. Relationships were integrated with man's behavior in his environment. Visual aids consisted of observing, studying, and understanding life as it existed; pickled specimens produced no such reaction as comparable to the out of door classroom.

It is indeed unfortunate that so living a subject as biology should be dead; that, materials so fresh and open should be stuffy and canned. Since biology is life, education is life, and life is learning, why not integrate all of these factors? How often we mislead ourselves by thinking that our students learn how to interpret natural phenomena solely from books and pickled specimens. Far more reaching effects, a creative and synthetic education could be obtained through a living and dynamic biology that occurs in nature.

In metropolitan areas, there are many parks that could be used to great advantage for such purposes. Once a week, the class could meet with the teacher in such a park and observe living things and their phenomena. Very often, full day or week end trips to the country might be planned. The educational possibilities and advantages are too numerous to mention herein. Certainly, high school and college students in metropolitan

areas would find biology the most interesting and valuable subject if we make it so. In rural communities, there are even greater opportunities for this work. Yet, it is an uncommon practice.

To study how plants and animals live and behave in their unique environments, their relationships to man and his living, is a study of life. How many students have ever seen living lichens, mosses, centipedes, sowbugs and other denizens of the woods. Books describe their habits and mode of living. Some students will know quite a bit about a moss plant after reading their texts. When they enter the fields, they cannot recognize a moss plant nor do they realize any value of these organisms to man and the environment. Biology, perhaps more so than other subjects, can teach children the "ways of living" if we will provide the means.

ACKNOWLEDGMENT

The writer is grateful to Professor Charles J. Pieper, chairman of the science department and to Dr. Lyman B. Graybeal of the School of Education of New York University for their helpful suggestions in formulating the questionnaire. Thanks are also due to Mr. George T. Hastings, chairman of the department of biology of the Theodore Roosevelt High School, to Miss Edith Read, chairman of the department of biology of the Morris High School, and to Mr. Max Mandel, acting chairman of the department of biology of the Evander Childs High School for granting the writer permission to conduct this investigation in their respective schools. The teachers of the many biology classes were most kind in co-operating with the administration of the questionnaire.

TIN DEPOSIT AT MAJUBA HILL, NEVADA

The Geological Survey, United States Department of the Interior, has prepared and placed in its open files at Washington, D. C., a preliminary report, accompanied by surface and underground geologic maps, on the tin deposit at Majuba Hill, Pershing County, Nevada. This deposit, which was discovered in 1917 during copper mining, was examined in April 1939 as part of the Geological Survey's strategic minerals investigations, under an allotment from the Public Works Administration.

The tin deposit is in a Tertiary rhyolite porphyry. Its dimensions, as exposed underground, are less than 20 by 20 by 10 feet, but it has been cut off by a normal fault, and the footwall portion has not been found. The tin mineral, cassiterite, is associated with tourmaline, quartz, and sericite. These other minerals are widespread in the rhyolite porphyry, but they are not accompanied by visible amounts of cassiterite except in the deposit cited and therefore cannot be regarded as local guides to tin ore.

The copper deposit, geologically younger than the tin deposit, was formed in the normal fault about 300 feet from the tin deposit. No copper ore has been mined at Majuba Hill since 1918.

THE PHYSICS TEACHER FACES HIS PROBLEMS

J. T. Peters
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Elsie H. Martens[1] brings us face to face with the first and perhaps most serious problem facing *all* teachers in the secondary schools in particular. She reminds us that today more than 60 per cent of our population from 14 to 17 years of age is in school. Instead of having the highly selected population of a generation ago to deal with, we have a heterogeneous mass of young people, many of whom are incapable of abstract thought and are only bored or irritated by efforts to improve their verbal achievements. Even so-called subnormal children who have been enrolled in special classes in elementary schools are being passed on into the high school. In 1937, 43 selected school systems reported that of thirty thousand retarded adolescents more than 16 per cent were receiving special instruction in the junior and senior high schools. She further stated that the secondary school has come to be looked upon as the responsible agency for adolescents, regardless of academic qualifications. It must admit and administer to the needs of pupils of IQ's of 80 or lower simply because they are adolescents.

Dr. T. D. Cope,[2] of the University of Pennsylvania, before a meeting of the American Association of Physics Teachers, refers us to a book published at the University of Pennsylvania.[3] He commends parts of the book to us but expresses surprise at some of the statements made. For example, on page 30 he finds these sentences, "The task of the secondary school is not that of developing leaders; it is one of lifting the masses. . . . Being tax-supported, it exists for all the children of all the people, not for the mental aristocracy."

So far, we have suggested problems common to all teachers in public secondary schools of the United States, not merely to teachers of physics. Let us inquire into the situation in another country, often referred to as another democracy, England. Elsie V. Parker,[4] says, "Our biggest problem is to reduce our size of classes. Half of our children are taught in classes of over forty and we feel this is the standing disgrace

[1] "Home Economics for the Handicapped Pupil," *Education Digest*, 4, 140 (1938).
[2] Paper read at Chapel Hill, N. C., February, 1937.
[3] *The High School Science Teacher and His Work.*
[4] President of the National Union of Teachers of England, *Education Digest*, 4, 48 (1938).

of the educational system of England. We are trying our best, by means of a film, to educate the public that it is wasting money this way." And again we find J. A. Lauwerys[5] pointing out the outstanding characteristics of the American school system to a visitor from abroad. They are: (1) enormous size of secondary school population, (2) enormous size of individual schools, (3) the great popularity of Biology over Chemistry in secondary school science, and (4) the keen awareness of the American science teacher of his social responsibilities and his idealism. He suggests that, in spite of this idealism, high school teachers are as pedantic and abstract in the classroom as those in England. He deplores the low level of performance and efficiency of science teachers he has observed in the United States. He illustrates by using the following points: (1) questioning seems to have degenerated into a guessing competition, (2) few lessons he observed concluded with a summary of work done by way of articulation, (3) few lessons ended with questioning and evaluation, (4) blackboard writing seems to be a lost art. No teacher observed developed his lesson on the blackboard. Mr. Lauwerys concluded by stating, however that in the United States there is far more concern with the ideal of democracy and a realization that it is not merely a form of government but a way of living together and that science teachers are more sensitive to the needs of such a democracy than their colleagues in England. In England only 10 to 15 per cent of the high school aged children ever enter secondary schools.

We see, then, the problem facing all teachers, a world whose geographical frontiers have disappeared and whose economic system has all but gone on the rocks, a world in which more is spent on armaments in one week than for the whole educational system of the world in one year in a futile attempt to achieve truce through fear and not lasting peace through education for cooperation; a world in which many false economies are effected to the degradation of education and consequently of society of the future, a world of unemployment so severe that in many sections older boys and girls must be kept from the labor markets, regardless of capacities for learning, by sending them to school.

The question before us, then is, what can the physics teacher hope to do in such a world of chaos? What can he do with his elaborate discussions, experiments and outlines on Force, Mat-

[5] Lecturer and tutor at the University of London, *Science Education*, March and April, 1938.

ter and Energy, with his studies usually catalogued under such headings as Mechanics, Heat, Sound, Light, Electricity and Magnetism? Can he bring inspiration and new courage to underprivileged, undernourished and ill-housed pupils? Can he help make up for parental neglect? Can he help instill ideals of democracy? Can he help in developing skills and in providing for worthy use of leisure, now so abundant? Can he help prepare better students for colleges and engineering schools and consequently for leadership in engineering, medicine and teaching professions? Or, to use the words found in the *Cardinal Principles of Education*, can he help in developing, "in each individual the knowledge, interests, ideals, habits and powers whereby he will find his place and use that place to shape both himself and society toward ever nobler ends?"

The answer to all of these questions is, *of course he can help*. Physics is so close to life and so much a part of daily life that we dare not omit it or ignore it in our educatiohal systems. The training and knowledge gained from studies of physics is too valuable for it to be ignored by our young people. From morning to night, each one of us pushes buttons and pulls switches and makes use of appliances which enrich and simplify living so much. Such appliances and conveniences have come in large measure from the physicist who received his beginning urge back in the high school and college class or laboratory.

If these statements be true why then the constant and continual shunning of physics courses by both high school and college students? Why the continual drop in enrollment in comparison to other courses of study? Perhaps we need to verify this statement.

From a digest of an article by C. K. Fountain,[6] we find that surveys of schools in various parts of the south indicate that physics is not being given in as large a percentage of high schools, nor is it being elected by as many students where given, as it was twenty years ago. Among the many suggestions offered as causes are: (1) general belief by students, parents and school executives that physics is useful only for students planning for some field of engineering, (2) physics taught in the high schools is being ignored by colleges and universities, (3) budget cutting is most effective when applied to physics equipment, (4) physicists do not advertise their accomplishments, (5) physics courses have been too hard and formal, (6) laboratory apparatus

[6] *Am. J. Phys.* (*Am. Phys. T.*), 4, 135 (1938).

has been too complicated and unfamiliar. To offset this tendency Mr. Fountain thinks we should, (1) show that physics is the easiest of all subjects with which to learn to think, (2) show that we use physics in every move we make, in games and in our work, (3) show that physics helps us judge most of the materials and the machinery we buy.

According to the section on secondary education of the *Works Survey of the Philadelphia Schools*, published in 1937, there was an increase in the number of science teachers of only 10 per cent in the period of rapid expansion of Philadelphia school population from 1927 to 1936. During that period, there was an increase of 68 per cent in enrollment, an increase of 42 per cent of English teachers (English is a required course for the four years), an increase of 32 per cent in teachers of social studies, business course teachers, 65 per cent increase, mathematics teachers, 2 per cent increase, and foreign language teachers, a decrease of 10 per cent.

From a survey carried on in 33 standard women's colleges, Professor Daffin[7] of Mary Baldwin College found that only 5 per cent of all students took a first year course in physics, physics ranking a poor third to biology and chemistry. The student ratios were physics, 1, chemistry, 2, and biology, 3, for beginning courses but, for majors elected, the ratios were physics 1, chemistry, 6, and biology, 10. In the same article we read a statement from a director of higher education in a state department of education and a former physics teacher: "It is true that at this moment chemistry and biology have the edge so far as state board regulations are concerned. Such advantages as they enjoy, though, have come largely because physics failed to measure up to its opportunities when it had a chance. Physics, like Latin, is about to be destroyed by its own advocates."

Dr. Knowlton[8] of the Physics Department of Reed College, says, "There is no use attempting to evade the fact that physics has a bad name among students in both high school and college. Too often the student of general physics shares the opinion of that friend of my youth who inscribed his text with these lines,

'Should there be another flood
For refuge hither fly.
Though all around be wet
This book will still be dry.'

[7] "Why the Woman Student Does Not Elect Physics," *Am. J. Phys.* (*Am. Phys. T.*), 5, 82 (1937).
[8] *Am. J. Phys.* (*Am. Phys. T.*), 4, 71 (1938).

When a number of students who had had experience in other sciences than physics were asked to compare the introductory courses, the replies could be boiled down to the following points:

(1) Chemistry and biology have more obvious applications to life.

(2) Chemistry, in particular, in more colorful. Anything is likely to happen at any time in the laboratory.

(3) Most students have a greater feeling of having understood or mastered materials and theories in chemistry and biology.

Professor Knowlton suggests that, because the field is extensive, the course is too superficial and the student leaves it with no sense of mastery. Rather than give easy introductory courses, we should select certain topics and try to make them appeal to individual students, giving them enough to insure a feeling of accomplishment. A course in modern physics is one suggestion. A course in sound for music students is another. From these selective courses, a few students may be found who will desire to carry their studies farther in physics.

Quite in accord with Dr. Knowlton's opinion, that introductory courses in college physics are too full and all inclusive and consequently superficial, come these statements from Mr. Elliot R. Downing,[9] in an article entitled, "A New Interpretation of the Function of High School Science." "These studies show that it takes high school students two or three weeks to understand and gain facility in application of one of the usual laws or principles of physics. Analysis of a dozen modern textbooks of physics show that the authors attempt to present twenty-three to forty-three principles together with a great deal of factual material not connected with these principles." Mr. Downing feels that high school teachers should concentrate on helping students master a small number of physical principles most often needed in the solution of everyday problems of life, and that colleges should change their entrance requirements so as to encourage such changes in high school physics. He feels that at present college entrance examinations contain much more factual information than the student can memorize if at the same time he is attempting to learn physical principles.

Referring again to the article by Professor Daffin, we find him quoting from a director of a division of survey and field activities in a teacher's college, "I think you are quite right in as-

[9] *Journal Higher Ed.* (October, 1933).

suming that the materials included in physics should be revised . . . . " I believe physics has a great deal to contribute to the general education of both men and women." The writer does not advocate an easy course in introductory physics but a revised one, concentrating on fewer essential principles and laws, and an interesting course.

Such views come not only from teachers in the United States but also from those in other countries. Mr. John Pilley[10] from the University of Bristol, says, "The influences that went to make science teaching of the past so very narrow in its outlook have today lost most of their force. It is now open to teachers to devise a kind of science teaching that will be of greater value than anything which has yet been established in preparing young people to undertake the responsibilities of adult citizenship in a democratic society." He further states that physics in particular can help young people understand how the simplest forms of classification and the simplest causal relationships, which form the basis of all science, are recognized. It also affords young people an opportunity to obtain mastery of precise statement in describing things and events and also shows them how more abstract terms may be used to effect economies in thought and communication.

Now what of the many and oft repeated statements from college teachers that the physics taught in the average high school has no value as a preparation for college physics? At one time the writer held somewhat the same views—when he was teaching college physics himself. There were few scientific data to bear out this view however. Since changing to the high school teaching field the writer has found the problems confronting the physics teacher there much more serious and complicated than ever before realized. Such teachers must not only teach a few students preparing for college but must keep in mind the much larger group who will not continue their academic endeavors after high school. He must try to meet college entrance requirements in his presentation, include at least a few units from the ever-widening field of modern physics, and still keep the work interesting enough and interspersed with enough applications so that the students will not boycott his classes. Keep in mind, too, the data presented early in this paper to the effect that secondary schools now contain many students of IQ's of 80 or lower. Let us refer to only two investigations in regard to

[10] *Am. J. Phys.* (*Am. Phys. T.*), 6, 218 (1938).

this question under consideration. L. B. Ham,[11] of the University of Arkansas, reporting on the results of a testing program concludes, "The common statement that high school physics has no value for those taking college physics is not confirmed. Compared with the effect of mathematical preparation, as received by students tested, the effects of high school physics on the final college physics grade for the first semester is shown to be comparable or nearly comparable." And from the college physics testing program,[12] we read, "if we rule out sampling and all other factors that might easily account for these differences, then we may tentatively conclude that the requirement of algebra, trigonometry, and high school physics favors higher averages in elementary college physics."

Mr. A. S. Adams,[13] of the Colorado School of Mines in "The Science Teacher's Dilemma," finds the teacher of science usually taking one or the other of the horns of the dilemma; purely factual teaching with showy experiments and no or very little connection to logical processes, or emphasis upon quantitative mental discipline with little connection between the students world and the mathematical rigor involved in his science work. The writer feels that usually the high school physics teacher takes the former view, and the college physics teacher the latter. Mr. Adams suggests that rather than take either idea we should carefully consider the development of the science itself and let the students' thought habits and processes develop with the historical development of the sciences. The course should be developed on a common sense basis.

At a meeting of Physics and Chemistry Teachers of the Philadelphia Schools, called in October, 1938 by Dr. Wildman, then Director of Science, the writer was given an opportunity to ask teachers of physics how they were meeting the problems of ever-expanding subject material, large classes and low ability levels of students. Many interesting answers were given and suggestions made. Some find it essential to omit sections on circular motion, the automobile, the pendulum, and practically all of modern physics. Others cut down on problem work and time allotted for studies of the telephone and telegraph and of the spectroscope. A suggestion came from one high school to give historical physics and let the applications be taken care of

[11] *Am. J. Phys.* (*Am. Phys. T.*), 4, 190 (1936).
[12] Special Bul., *Am. J. Phys.* (*Am. Phys. T.*) (September 1934).
[13] *Am. J. Phys.* (*Am. Phys. T.*), 3, 61 (1935).

in Faraday clubs, etc., meeting after school hours. From another high school came the suggestion that modern physics and most applications be cared for by reports from better pupils. Another teacher suggested that a few survey experiments should be used such as energy transformations in the school heat and power plant. At a meeting of representatives from the Philadelphia High School Physics Teachers, the late Dr. Landis, seemed to voice the sentiment of most teachers present by requesting that an extra term of mathematics be required for those taking academic physics. Some felt that it would be much better however to require an extra term of physics. Certain it is that most physics teachers must spend some considerable time teaching pupils how to manage the decimal point and the elusive exponent.

The Philadelphia Schools have tried to meet the ability level problem by setting up separate courses in physics for those taking industrial courses and not planning for college. Such courses are called Applied Physics or Practical Physics, and Applied Mechanics, one term being devoted to Mensuration, Density and Specific Gravity, Fluids in Motion and Heat, and the other term to Simple Machines, Tensile Strength, Elasticity and Laws of Motion. Within the past six years yet another set of science courses has been developed for those enrolled in a curriculum called by various names such as Modified, Sub-Academic, etc. Such science courses are called various names, too, an effort being made not to hurt the dignity of the pupils concerned. Such pupils are those who have failed a great many subjects for two or more terms. Such science courses are in the developmental stages and probably will have to remain so. They might be called super-diluted courses at best but I believe they are meeting a real need. They no doubt need to be made more practical.

Out of this wordy background may we attempt to emerge with a few very definite and perhaps scientific suggestions to meet the many problems of the physics teacher.

1. Let us accept the challenge to teach physics to the masses. They need it and we *can* present it so that they can understand most of it.
2. Let us join in with administrators and educators and work for better support of our schools so that we can have smaller classes and do better work.
3. Let us arrange for different levels of work to meet the

preparation and ability levels of pupils. It is done in English classes, why not in Physics classes.

4. Let us demand that students be taught to read and decipher before being passed on to high schools.
5. Let us insist that college preparatory students have at least one term extra work in mathematics before physics or, better still, be allowed one year for classical physics and another year for applications, problems and modern physics.
6. If an allowance of two years is impossible then let us cut down on the content of the course and include only the bare essentials.
7. Let us offer additional courses in such branches as sound and light and modern physics with no pre-requisites, so as to attract a few additional pupils into the field.
8. Let us insist that college entrance examinations include only fundamental principles and not too many facts depending upon memory alone.
9. Let us ask our colleagues in colleges to refrain from sacrificing the interest and possible devotion of excellent future teachers to the great god ***rigor.***
10. Let us insist that prospective physics teachers have *Physics* courses as well as ***Methods of teaching*** in their preparation for high school work.
11. Let us make our teaching alive and meaningful, and keep the human touch in it always.

ARTIFICIAL HURRICANES TO TEST ARMY PLANES

The power of 40,000 horses will be yielded by a single motor just completed at the Westinghouse works. Largest of its kind, the giant motor will drive air as fast as 400 miles per hour through the Air Corps' new plane-testing wind tunnel at Wright Field, Dayton, Ohio.

It is expected to be completed and ready for testing full-sized plane propeller and engine enclosures by July 1. The motor will turn two fans, each as tall as a four-story building, and with 16 blades.

The frame of the motor is so big that a small truck could be driven through when the 50-ton motor is removed.

Despite its size, explained C. M. Laffoon, Westinghouse engineer, the speed can be varied from 37 to 297 revolutions per minute. Ordinarily the speed of such an induction motor would be regulated by rheostats and resistances through which excess power would be used up as heat when operating at reduced speeds. To eliminate much of this waste of electrical energy, the Air Corps engineers have devised a system of two motor-generator sets, which are also being built by Westinghouse.

A CONVENIENT METHOD TO REMOVE FORMALIN FROM PRESERVED BIOLOGICAL SPECIMENS

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Instructors and students who are exposed repeatedly to the formalin contained in preserved biological specimens often find their laboratory periods extremely disagreeable, and, occasionally hazardous. Induction or aggravation of the common cold, severe dermatitis, bronchitis, and asthma are the chief hazards of exposure to formalin. A method is needed to remove this common laboratory preservative.[1]

Dr. Foust, et al.,[2] reported the value of a 5% urea and 1% ammonium phosphate solution in removing formalin from preserved specimens. Following the directions given in this article, the writers attempted to deformalinize bullfrogs, dogfish, starfish, etc., but failed to obtain satisfactory results. Therefore, we sought to develop another method to achieve the desired result.

Many substances react with the aldehydes by oxidation, reduction, substitution, and addition. The following properties would be desirable in any suitable reactant:

1. It should remove formalin completely.
2. It should be reasonable in cost.
3. It should react quickly. The reaction products should be colorless, easily removed and should cause no deleterious effects on the specimens.
4. It should undergo slight or no deterioration after repeated use in the deformalinization process or after standing for long periods of time.
5. It should be easy to prepare.
6. It should not be closely limited in composition.
7. It should not evolve toxic or objectionable odors during the reaction.
8. It should not corrode containers. (see page 570, 5.)

After making a series of small scale tests with some forty laboratory reagents known to react with formalin, we selected sodium bisulfite, $NaHSO_3$, as most closely approximating the qualities of a suitable reactant with the exception of items

[1] Pope, P. H., *Science*, 73, 495 (1931).
[2] Foust, H. F., T. S. Leith, H. M. Tabbut, and L. Bowstead, *Science*, 83, 498 (1935).

number six and seven above. An aqueous solution of this reagent was entirely suitable insofar as it completely destroyed the formalin odor of preserved specimens immersed in it within 3 to 5 minutes. The largest specimen required the greatest length of time.

During the reacting period, however, this solution evolved sulfur dioxide gas, SO_2, in such amounts as to nullify its usefulness in the classroom. The SO_2 may have been formed for several reasons, of which the following two appear the most important:

1. Formic acid, formed by oxidation of the formaldehyde preservative, might liberate SO_2 from the $NaHSO_3$ as would any acid with a sulfite solution.
2. Sodium metabisulfite, $Na_2S_2O_5$, is probably present in the "technical" grade of sodium bisulfite used in these experiments. This substance might form sulfurous acid with water in such concentrations as to cause the sulfite solution to evolve SO_2.

It appeared that these sources of SO_2 could be eliminated by reducing the H ion concentration of the reactant solution. This was accomplished by buffering the solution with Na_2SO_3.

In determining the optimum ratio of sulfite to bisulfite in the solution and the most suitable concentration of the latter, these points were taken into consideration:

1. The $NaHSO_3$ should be sufficiently concentrated in the solution to permit the daily use in the classroom for a semester without renewal. If it is too concentrated, however, there may be excessive loss of ingredients through creeping, oxidation, and mechanical adherence to the specimens.
2. The amount of Na_2SO_3 should be just sufficient to prevent the escape of the sulfur dioxide. This salt renders the bisulfite solution much less acid, whereas the reaction with the formalin proceeds best with the bisulfite alone, which is more strongly acid.

With these objectives in mind a considerable range of concentrations were tried out first on small scale tests and then in actual classroom use. The most satisfactory solution was one containing 5.7% (by weight) of $NaHSO_3$ and 3.8% (by weight) of Na_2SO_3. This solution will remove the formalin satisfactorily from many specimens throughout a semester without renewal.

We may now detail the essential points in the preparation and use of the sulfite-bisulfite solution:

1. The deformalinizing solution contains 5.7% (by weight) of

$NaHSO_3$ and 3.8% (by weight) of Na_2SO_3 dissolved in tap water. A deviation of 1 to 5% from the above figures would probably introduce no serious failure of the solution to function properly. It is our experience that 20–30 liters of the solution will last a full semester in the daily removal of formalin from any specimens in use in a zoology class of 35 students. To prepare 20 liters of solution dissolve 1260 grams of $NaHSO_3$ and 840 grams of Na_2SO_3 in tap water.

2. Specimens removed from their formalin bath are given a brief preliminary rinsing under the tap, and then immersed in the sulfite-bisulfite solution from 3 to 5 minutes. As many specimens as can be conveniently handled may be deformalinized simultaneously. Following a final quick rinse, the specimens or those which may have been injected with various formalin mixtures may require subsequent short immersions as dissection proceeds.
3. Failure of the solution after repeated usage to remove the formalin promptly may require the addition of more $NaHSO_3$ just short of the point where SO_2 gas is evolved. Evidence of SO_2 arising during the routine employment of the solution calls for the addition of small amounts of Na_2SO_3. There is a considerable variation in the actual amounts of $NaHSO_3$ and of Na_2SO_3 in the technical grade of these chemicals. This should be kept in mind and the amount of one or the other reagent increased as may be necessary to give a satisfactory solution. A pH determination of the solution gives a reasonably easy method of ascertaining if it has been properly prepared. The solution of the concentration specified has a pH of about 6.4. One containing insufficient Na_2SO_3 and which may therefore evolve sulfur dioxide, will have a lower pH. One containing an excess of Na_2SO_3 will have a higher pH.
4. Although certain specimens, frogs for example, may be stored for several weeks in the reactant solution without impairing their dissecting qualities, others such as the dogfish become soft after 5 to 6 days and unsuitable for dissection. In other words, the solution is not a substitute for formalin. After the removal of the formalin, the specimen may be kept in any other satisfactory preservative, or, returned to formalin.
5. The solution should be kept in common glazed earthenware laboratory crocks as it will slowly attach metal containers.

THE COMMERCIAL MATHEMATICS CURRICULUM

WALTER F. CASSIDY
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It has been often stated that the decline in the number of schools offering courses in commercial mathematics may be attributed directly to the fact that teachers of this subject cannot establish a real need for such a course. Research workers have often been advised to determine the proper content of a course of study in mathematics that would suitably prepare the pupil to satisfy the mathematical requirements of his commercial career. The trend is now definitely towards a validation of informational aims rather than operational skills.

The writer of this investigation has been concerned only with validating some mathematical items for the commercial mathematics curriculum. This justification, or validation, has been made by subjecting commercial mathematical items to specific tests or criteria for social and vocational usefulness. By usefulness is meant fitness for some desirable, practical purpose. Social usefulness, in this dissertation, means the preparation of the individual, through a course in commercial mathe matics, for effective social contacts and relationships with his associates in his daily community life. Vocational usefulness, in this dissertation, means the preparation of the pupil, through a course in commercial mathematics, for efficient business life.

The two major bases for this validation, therefore, were social and vocational utility. Specifically, the writer has set up 6 separate and independent criteria to determine "usefulness." One of the 6 criteria is concerned with validation for social utility, and the remaining 5 criteria are concerned with validation for vocational utility. Thus, for any mathematical item to be finally validated, it must have satisfied either the one criterion for social utility, or 2 of the 5 criteria for vocational utility.

The specific steps in the procedure were as follows:

1. The preparation of a check list of commercial mathematics items. These items were taken from 10 text-books in commercial mathematics. Ten were considered an adequate sampling since these books are representative selections of prominent publishers in this field. Each book was carefully studied for items to be included in the list. These items were then checked for accuracy and completeness.

This check list was used in the following manner: The items in the list were written in alphabetical order on the left side of sheets of cross-section paper in the form of a table. A separate column was used for tabulating the items in each issue of a trade journal, each text-book, each piece of business machine literature, etc. Letters and numbers were placed at the head of each column, as needed, for the purpose of designating the issue used, etc. The first letter of each author's surname was inserted in the heading of the columns reserved for theses and text-books. The first two letters of the month at the headings of the columns showed the issue used in the analysis of trade journals. Arabic numerals, at the headings of the proper columns, designated different pieces of business machine literature, answers of the individual accountants, and various civil service examinations.

The analysis of theses, accounting and bookkeeping text-books, etc., was then made in the following manner: The materials were carefully read for mathematical items. When an item was found, an "x" was placed against the item in the column of the table under the proper heading. This "x" merely showed that the item had been found at least once in a certain text-book, trade journal, or other source. A frequency count was not kept for a particular volume, since it is believed that, in a study of this type, a repetition of occurrence within a particular volume, issue, or piece of literature, might not necessarily be significant. However, the recurrence of the same item at least once in many volumes was judged important, because a single occurrence in each of many and varied issues has more validity than many occurrences of the same item in a single issue.

The truth of this fact was especially exemplified in the analysis of trade journals. The following example of many similar will suffice. The word "inventory" occurs very frequently in the *Journal of Accountancy*, during the year 1939, because of the McKesson and Robbins Case which was prominent at the time. Yet, a frequency count would not give the true value of this item in the commercial mathematics curriculum.

When an item, which was not present in the check list, was found in a thesis, accounting and bookkeeping text-book, trade journal, etc., it was immediately included in the list in its alphabetical place. The experience and judgement of the writer were used in deciding upon the inclusion of these new items in the list.

2. The second step in the procedure was the validation of the

mathematical items in the list by the application of the one criterion for social utility. This criterion came out of the analysis of 7 theses dealing with the social utility of some mathematical items. Thus, for an item to satisfy the test of social utility, it must be found at least once in 4 or more of 7 theses. The reason that 4 out of 7 were selected was that 4 constituted a majority in this case. Under social utility one considers such situations as buying, investing, reading, traveling, and the general economic activities of county, state, and nation.

The titles of 11 theses dealing with the social utility of some mathematical items were selected from various sources. These theses were procured and read. Two were rejected because the scope of their problems was too broad for use in a study involving specific items. Two other theses were eliminated because they dealt with operational skills and were not usable in the present study which is limited solely to informational mathematics. Thus, the 7 remaining theses were subsequently analyzed for commercial mathematical items.

3. The third step in the procedure was the validation of the mathematical items in the check list by the application of each of the 5 criteria for vocational utility. Thus, although an item might fail to be validated by the criterion of social utility, it was considered validated, nevertheless, if it satisfied 2 of the 5 criteria under the test of vocational utility. For an item to satisfy 2 of the 5 criteria, rather than 3 of 5, is, in itself, a severe test because of the high standard which the item must meet in each, separate criterion. This fact will be borne out when the degrees of validation are shown. These 5 criteria were established:

(a) From an analysis of 7 accounting and bookkeeping textbooks. Thus, for an item to satisfy this particular criterion for vocational utility, it must be found at least once in 4 or more of 7 high school and college accounting and bookkeeping textbooks. Four out of 7 were selected because 4 constituted a majority in this instance. The reason for using high school and college accounting and bookkeeping text-books was that commercial students usually take at least introductory courses in accounting and bookkeeping, since these subjects are basic necessities in every business. It has been found necessary in commercial schools to give a course in commercial mathematics either as pre-requisite to, or as co-requisite with, the accounting course. The accounting and bookkeeping text-books were ana-

lyzed for mathematical items, since the presence of these items in such text-books furnishes a validation for the items in a commercial mathematics course. These 10 books were considered a fair sampling, since 4 are college text-books used in such prominent universities as Columbia, Northwestern, and Michigan, and the other 3 are high school texts used in such cities as Buffalo, New York, and Pittsburgh.

(b) From an analysis of 155 pieces of sales promotion literature of 6 prominent business machine companies. Thus, for an item to satisfy this second criterion for vocational utility, it must be found at least once in the sales promotion literature of 3 or more of 6 business machine companies. It was thought that for this criterion 3 out of 6, rather than 4 out of 6, a majority, would be a test of sufficient severity. The literature of business machine companies was used for the reason that the personnel managers of several large companies stated to this writer that the prime requisite for almost all clerical positions is efficiency on at least one business machine. Although at first glance this may appear to be an operational skill, nevertheless, it is an informational skill as well, since the use of billing and bookkeeping machines requires considerable factual (informational) knowledge. Thus, the student in the commercial curriculum has to become efficient in business machine operation in order to perform successfully his future clerical duties. An office machine operator should be more than a robot. He should understand the mathematical ideas behind the machine's calculations and postings. These mathematical ideas are the mathematical items described in the sales literature of 6 business machine companies. Therefore, an analysis of mathematical items found in the sales literature of 6 prominent business machine companies would serve, it seemed, to furnish a criterion for validation.

(c) From an analysis of 17 civil service examinations. For an item to satisfy this third criterion for vocational utility, it must be found at least once in 9 or more of 17 civil service examinations. Nine out of 17 were selected because 9 constituted a majority in this instance. The reason for using civil service examinations was that in such examinations, items for the commercial mathematics curriculum are quite likely to be found. Since some mathematical items are found in civil service examinations, such examinations furnish a criterion for validation.

It was planned, at first, to use Federal, New York State, and New York City examinations for the positions of clerk, account-

ant, and bookkeeper. It was hoped, also, that the Navy Department would allow the use of the yeoman examinations through which enlisted men are promoted. Unfortunately, the only examinations available for investigation were those of New York City. Only in the files of the Delehanty Civil Service Institute, and in the office of *The Chief* a New York City Civil Service Weekly, were these examinations available.

(d) From an analysis of one year's issue of each of 6 national trade journals. Five of these were chosen from the year 1938, and one from July 1938 to June 1939. Thus, for an item to satisfy this fourth criterion for vocational utility, it must be found at least once in half or more of the total number of one year's issue of a single trade journal. It was thought that, for this criterion, half of the total number of issues, rather than a majority of the total number, would be a test of sufficient severity. The reason for using these trade journals was that each branch of business, such as insurance, retailing, banking, etc., has its own mathematical requirements, each differing somewhat from the others. A cross-section of these requirements is determined by an examination of the mathematical items found in one year's issue of 6 trade journals. The 6 journals used have a national circulation, and give an insight into the mathematical requirements of accounting, investment banking, public utilities, retailing, credit organization, and insurance.

(e) From an analysis of the answers to the check list submitted to 50 certified public accountants. Thus, for an item to satisfy this fifth criterion for vocational utility, it must have been found in 26 or more of 50 answers of these accountants. Twenty-six out of 50 were selected because 26 constituted a majority in this case. The testimony of these accountants was used for the reason that certified public accountants utilize many items of commercial mathematics in their audits, which cover all fields of business endeavor. Such accountants are competent judges of the vocational utility of specific mathematical items, and 50 are considered an adequate sampling. The check list was submitted to 50 certified public accountants, and it was explained to them that this present study had for its object the validation of some basic mathematical items for the commercial curriculum. The accountants were informed that the list was merely suggestive, and that any other items which they thought should be included, were to be added.

The accountants were asked to use the numerals 3, 2, and 1,

respectively, against the items which they thought were of most importance, of medium importance, and of least importance, but which, nevertheless, should be retained in the curriculum. Thus, the relative importance of items, as far as the accountants were concerned, was indicated, The accountants were requested not to place any numeral next to items in the check list, which they considered unnecessary.

The fourth and the following steps in the procedure were: (4) the preparation of the necessary tables; (5) the organization and presentation of the data under 3 categories, namely: (a) Accounting and Bookkeeping Items, (b) Banking and Investment Items, and (c) Graphic Items; (6) the enumeration of items found in each of the 6 sources; (7) the determination of the composite rank of each item from the individual ranks which the item held in each of the 6 sources; (8) the validation of the mathematical items in the check list by the application of the criterion for social utility; (9) the validation of the mathematical items in the check list by the application of the 5 criteria for vocational utility; (10) the determination of the degrees of validation of the items in the check list, when the criteria are increased beyond 2; (11) the summarizing of the findings of the study; and (12) the drawing of conclusions from the findings.

From the composite rank the curriculum builder can determine the importance of items for the content of the commercial mathematics course. This composite rank is the arithmetic mean of the item's ranking in all six sources. Simple interest held the highest relative position of any item in the 3 categories, that of 1.5. The item in the second highest position was inventory taking, which had a rank of 2.3. The items are presented in the order of their composite ranks in the table which follows:

Items	*Rank*
Simple interest	1.5
Inventory taking	2.3
Assets of business	2.7
Cost	
Income	
Trade discount	2.8
Liabilities	
Income taxes	
Real estate taxes	3.0
Depreciation of assets	3.2
Cash	
Credit	
Accounts receivable	3.3
Bank discount	
Sales records	

Balance sheet	3.5
Budgeting	3.7
Annuities	3.8
Compound interest	
Cash discount	
Net profits	
Accounts payable	4.0
Commission	
Gross profits	
Mortgage	
Assessed valuation of property	4.3
Checking accounts	
Debt	
Dividends from stock	
Debit	4.5
Fire insurance	
Operating expenses	
Bank balances	
Interest bearing notes	
Promissory notes	
Market value of stock	
Discounting of notes	4.7
Maturity of notes	
Statement of profit and loss	
Tax rate	
Cost of bonds	4.8
Installment buying	
Life insurance	
Hour rate system of wages	5.0
Payroll distribution sheet	
Surplus profits	
Reserves	
Overhead expenses	5.2
Pensions	
Bankruptcy	5.3
Cost of labor	
Productive labor	
Trade acceptance draft	
Net worth	5.3
Unemployment insurance	
Automobile insurance	5.5
Savings bank accounts	
Common stock	
Par value of stock	
Bank draft	5.7
Reconciliation of bank statements	
Non-productive labor	
Parcel post	
Distribution of profit and loss in partnerships	
Freight rate	5.8
Organization of corporations	
Premium on bonds	6.2
Yield of bonds	
Deficit	
Foreign money	
Sight draft	

Stock without par value	
Cost of transportation	6.3
Depletion of assets	
Discount on bonds	
Commercial draft	
Stock brokerage	
Tax on stock	
Preferred stock	
Accident insurance	6.5
Undivided profits	
Partial payments	6.7
Wages for overtime work	
Wages for piece work	
Bonus	6.8
Money order	
Stock exchange	
Broken line graph	7.0
Cash surrender value of life insurance	7.2
Building and loan associations	
Credit rating	
Currency denominations for payroll	
Excise taxes	
Several curves plotted on one graph	
Real estate brokerage	7.3
Health insurance	
Horizontal bar graph	
Equations of accounts	7.5
Divided bar graph	7.8
Single curve	
Duty	8.0
Vertical bar graph	8.2
Circle	
Scale drawing	8.3
Pictograph	
Square root	8.5

Budgeting and simple interest were the only items that met the one criterion for social utility and the five criteria for vocational utility.

Sixteen items met the one criterion for social utility and four of the five criteria for vocational utility:

1. Annuities
2. Assessed valuation on property
3. Assets of business
4. Depreciation of assets
5. Cash
6. Credit
7. Debt
8. Income
9. Compound interest
10. Life insurance
11. Installment buying
12. Inventory taking
13. Mortgage
14. Tax rate
15. Income taxes
16. Real estate taxes

Three items met the one criterion for social utility and three of the five criteria for vocational utility:

1. Building and loan associations
2. Trade acceptance
3. Foreign money

Twenty-eight items met only four of the five criteria for vocational utility:

1. Accounts payable
2. Accounts receivable
3. Balance sheet
4. Bank balances
5. Commission
6. Cost
7. Cost of bonds
8. Debit
9. Cash discount
10. Premium on bonds
11. Trade discount
12. Cost of labor
13. Productive labor
14. Liabilities
15. Fire insurance
16. Operating expenses
17. Overhead expenses
18. Parcel post
19. Payroll distribution
20. Statement of profit and loss
21. Gross profits
22. Net profits
23. Surplus profits
24. Sales records
25. Dividends from stock
26. Market value of stock
27. Par value of stock
28. Tax on stock

Twenty-seven items met only three of the five criteria for vocational utility:

1. Depletion of assets
2. Bankruptcy
3. Bonus
4. Credit rating
5. Freight rate
6. Savings bank accounts
7. Discount on bonds
8. Yield of bonds
9. Real estate brokerage
10. Stock brokerage
11. Unemployment insurance
12. Net worth
13. Discounting of notes
14. Interest-bearing notes
15. Maturity of notes
16. Partial payments
17. Non-productive labor
18. Organization of corporations
19. Distribution of profit and loss in partnership
20. Undivided profits
21. Cost of transportation
22. Reconciliation of bank statements
23. Common stock
24. Preferred stock
25. Stock without par value
26. Stock exchange
27. Hour rate system of wages

Twenty-three items met only two of the five criteria for vocational utility:

1. Amortization of bonds
2. Bank draft

3. Commercial draft
4. Sight draft
5. Time draft
6. Accident insurance
7. Automobile insurance
8. Currency denominations for payroll
9. Deficit
10. Pensions
11. Reserves
12. Sales taxes
13. Cash surrender value of life insurance
14. Health insurance
15. Money order
16. Divided bar graph
17. Vertical bar graph
18. Horizontal bar graph
19. Single curve graph
20. Several curves plotted on one graph
21. Broken line graph
22. Wages for overtime work
23. Wages for piece work

Seven items met only one of the five criteria for vocational utility:

1. Equations of accounts
2. Duty
3. Excise taxes
4. Circle graph
5. Pictograph
6. Scale drawing
7. Square root

Conclusions

The following conclusions were drawn from the study:

1) The value of the items in a commercial mathematics curriculum can be tested by the degrees of validation and by the composite ranking presented in this study.

2) The certified public accountants are conservative in their opinions regarding the items to be validated, since it is evident from their responses that they would rather have an item retained in the commercial mathematics curriculum than have it rejected entirely.

3) The list of items found in the trade journals furnishes a guide to the mathematical vocabulary requisite for intelligent reading of trade journals.

4) Mathematics teachers can determine from this study the types of graphs which should be taught and emphasized in the classroom because of their social and vocational utility.

EASTERN ASSOCIATION OF PHYSICS TEACHERS

One Hundred Forty-Seventh Meeting

MALDEN HIGH SCHOOL
Malden, Massachusetts

Saturday, March 15, 1941

10:00 Address of Welcome: Mr. Thornton Jenkins, Headmaster of Malden High School.
10:15 Report of Committee on New Apparatus: Dr. Andrew Longacre, Chairman.
Demonstration by Mr. Parker, of the Central Scientific Company.
11:15 Report of Committee on Study of Physics Enrollment in Schools: Mr. Charles B. Harrington, Chairman.
12:30 Luncheon: Malden High School Cafeteria.
2:00 Inspection of the new science laboratories at the high school.
2:30 Meeting of the Executive Committee.
2:45 Business Meeting.
Report of Committee on College Entrance Syllabus; Mr. Fred R. Miller, Chairman.
Report of Committee on New Books and Magazine Literature; Mr. Richard Porter-Boyer, Chairman.
3:00 Address by the Vice-President, Mr. John L. Clark.
Topic: Experiments with Liquid Air.

OFFICERS:

JOHN P. BRENNAN, President; High School, Somerville, Mass.
JOHN L. CLARK, Vice-President; Chapman Technical High School, New London, Connecticut.
Secretary, CARL W. STAPLES, Chelsea High School, Chelsea, Mass.
Treasurer, PRESTON W. SMITH, 208 Harvard Street, Dorchester, Mass.

COMMITTEES:

Executive Committee:
EVERETT J. FORD, English High School, Boston, Mass.
LAWRENCE A. HOWARD, High School, East Boston, Mass.
ROBERT W. PERRY, Malden High School, Malden, Mass.

New Books and Magazine Literature
RICHARD PORTER-BOYER, Chairman, High School, Newtonville, Mass.
FLOYD E. SOMERVILLE, High School, Newtonville, Mass.

New Apparatus
DR. ANDREW LONGACRE, Chairman, Phillips Exeter Academy, Exeter, N. H.

Committee on College Entrance Syllabus:
FRED R. MILLER, English High School, Boston, Mass.
DR. ANDREW LONGACRE, Phillips Exeter Academy Exeter, N. H.
ALBERT THORNDIKE, Milton Academy, Milton, Mass.

Study of Physics Enrollment in Schools.
CHARLES B. HARRINGTON, Chairman, Newton High School, Newtonville, Mass.

Business Meeting

R. E. Keirstead, Rogers High School, Newport, Rhode Island, and Joseph Hackett, Mechanic Arts High School, Boston, Massachusetts were elected to active membership.

Demonstration of New Apparatus

Mr. E. C. Bowen of the Central Scientific Company, 79 Amherst Street, Cambridge, demonstrated the following new pieces of physics equipment.

Cenco Oscillograph, One Inch Cathode Ray, No. 71546. This instrument was demonstrated connected with the new Cenco No. 74720 Rectifier Panel, Radio, No. 80806 Microphone and Coupling Unit so that the characteristic functions of A.C. sine waves, half wave rectification, and full-wave rectification were shown, as were also sound waves received through the radio. The wave form of words and sound through the microphone were illustrated. Details for the complete set-up of this equipment may be had by application to the company.

Cenco Airplane Force Apparatus No. 75441, Streamlining Grid No. 75444, and Streamlined Wing Section No. 75442. This apparatus was shown in use for measuring lift and drag of a model section of an airplane wing. The wing section is suspended from a special movable metal frame, on which its angle can be adjusted. By means of two independent rider weights, which are used to restore balance at any given point, it is possible to make accurate measurements of lift and drag from different angles of attack. The relation of a cambered section to a flat section may also be illustrated. The grid and fan units may be best be mounted in a wooden box.

Projection Meters. A new line of projection meters, No. 82545 for direct current and No. 82660 for alternating current. Both instruments have two plastic windows, through which the point and the scale are projected. One window on each instrument is the full size of the case to render visible the whole meter movement and its characteristics. For each of the projection meters there are available two range-extension boxes, one of which when connected to the meter to which it belongs makes the latter a 5-range voltmeter and the other a five-range ammeter. The volt ranges on the direct current are 1, 5, 10, 100, and 250; the current ranges are 10 and 100 milliamperes, and 1, 5, and 10 amperes. On A.C. the range is 5, 25, 50, 100, 250 volts, and 1, 2.5, 5, 10, and 25 amperes.

New Cenco-Edgerton Stroboscope, No. 74670. This is a simplified demonstration form of a new and important instrument. It consists of a Neon-filled Strobotron tube as a light source mounted on a reflector. When the grid of this tube is excited by the closing of a mechanical contactor, which is part of the instrument, the tube discharges a condenser with the result that there is a short brilliant pulse of light lasting for only about .00002 second. The condenser then recharges for the next flash. When this source of light is directed on a rotating part, such as an electric fan, the latter may be made to appear stationary when the speed of the contactor has been properly adjusted with reference to the speed of the rotating part.

Cenco Modified Lecture Table Projection Outfit. This consists of the standard Cenco Physics Lamp No. 66161-A mounted in a vertical position. A glass Petri dish or plate placed across the top lens of the lamp serves as a projection stage and the converging beam from the lamp is reflected at right angles onto the screen by means of a simple prism No. 65395. This instrument was demonstrated with the Cenco Wetting Agent No. 73860-A, with which the film of lycopodium powder sprinkled on the surface of the water was shown instantly to break apart when touched with the agent, and particles of sulphur placed on water were shown to sink when the surface tension was destroyed through contact with the wetting agent.

New Freezing Cryophorus. This cryophorus is a straight form with a spherical bulb at one end, while the bulb at the other end is in the form of a hemispherical container into which the freezing mixture may be placed directly, after the tube has been clamped in a horizontal position on a ring-stand. With a lamp and lenses the apparatus may be projected on a screen or on the ceiling. Two pieces of Polaroid J-film are placed to polarize the light passing through the cryophorus. Dry ice and acetone were used as the freezing mixture. When water freezes the color patterns projected make a beautiful demonstration.

Further Demonstrations of Archimedes Principle. Mr. W. Roscoe Fletcher of North High School, Worcester, demonstrated a cylinder of pine weighted with a brass plug, and of a size to fit not too closely in a 500 cc. graduate cylinder. It was weighed and 150 cc. of water placed in the cylinder. The pine cylinder was then placed in the water and was found to float in the small quantity of water. The level of the water was noted, the wooden cylinder was removed and water added to "fill the hole left by the cylinder." The weight of water required to do this could then be determined.

Three Demonstrations by Mr. Albert R. Clish, of Belmont Junior High School, Belmont, Mass.

The three demonstrations were:

1. A magnetic polarity indicator.
2. A static charge polarity indicator.
3. An ultra-violet lamp.

The first two are home-made.

The magnetic polarity indicator is made from a common charge- discharge type of auto ampere meter. The meter is mounted on an upright and a hole about one inch in diameter is made in the upright directly below and in contact with the meter. The north end of a known magnet is placed in the hole. The needle swings to one side. This side is labeled *north.* The polarity of unknown magnets can now be determined.

The static charge polarity indicator is not original with me. Meister and others have published the circuit in the past. I have made some improvements. It is best understood by a diagram. Fig. 1.

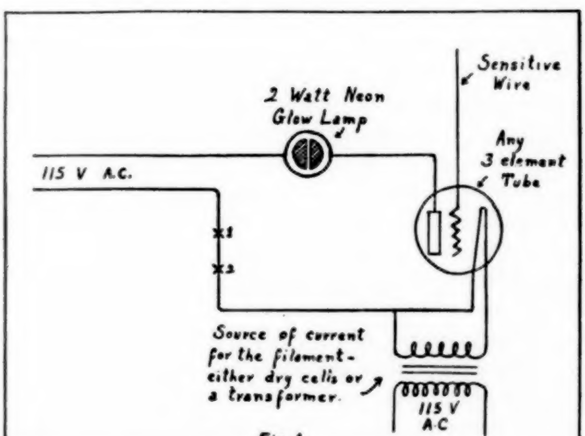


Fig. 1.

The "sensitive wire" may well be about two feet long. The lamp glows when connections are made. The lamp goes out when a positively charged body near or in contact with the sensitive wire is moved away. The lamp also goes out when a negatively charged body approaches the sensitive wire.

An earphone or amplifier may be cut into the circuit at x1 and x2 so as to provide an audio indicator.

The ultraviolet lamp is the new General Electric Purple X. It is made (as carefully marked on the bulb) *for intermittent use only*. The lamp is nearly identical with the common photoflood lamp. The envelope is a red-purple glass which is transparent to the ultraviolet. Its life is about 50 hours and like all "over-run" lamps it gets very hot. It should be used in a reflector, and, like all "over-run" lamps, it should not be directed toward the face. A piece of window screen over the opening of the reflector will remove any and all danger from glass—if and when it breaks. I have never seen this lamp or a photoflood lamp break yet, but they are known to break—therefore the caution printed on both the bulb and the package and the descriptive literature.

EXPERIMENTS WITH LIQUID AIR

Abstract of Address by the Vice-President,

MR. JOHN L. CLARK

I am demonstrating to you this afternoon some experiments which many of you have seen before, but, how many of you have tried them yourself? Probably not very many, due to conditions. There is, however, much pleasure in them, and they may also be used at assemblies to interest youngsters in taking science, especially physics. Perhaps this is not quite fair, as they may think that the subject is all just as interesting, but a little propaganda is justifiable. About town, too, it will help to give an idea of science, as much of it is general and spectacular, and not technical.

Itinerant demonstrators give perhaps forty-five experiments, too rapidly, and charge perhaps twenty-five dollars. It is unreasonable to pay as much as that when you can do it yourself. I will stress the difficulties, and advise you to try them outside class for the good effect in terms of courses.

Containers for the liquid air may be obtained from the Connecticut Gas Products Company, Meriden, Connecticut. One may count on losing by evaporation about ten percent in twenty-four hours. From this one may judge how much to get. In Boston there is one place listed, the Air Reduction Sales Company (Mr. C. Debridge), and the Linde Air Products Company also supply the material. It costs about $1.50 per liter. There are now about five liters in this large jug.

It is rather difficult to get information on experiments. There are three books. In the manufacture of liquid air ordinary air is freed from water vapor and carbon dioxide, and it is then compressed to 2200 pounds per square inch. By evaporation and expansive cooling of part of the air the rest is liquefied. Since these manufacturing companies concentrate on the oxygen which makes up about 21% of the air, the 78% nitrogen together

with the helium, neon, krypton, xenon, and radon, are ordinarily thrown away. Practically pure oxygen is thus obtained. This is pumped into large steel cylinders for shipping, and is used for welding, etc. Oxygen is thus the main product.

Dewar jugs for temporary storage of the liquid air are manufactured by the American Thermos Bottle Company, Norwich, Connecticut, and cost about twelve dollars for the large ones, and about seven dollars each for the smaller or 2 liter size. They are made of Pyrex, but are somewhat tricky to fill. The jug is at 72°F and the liquid air is at about −300°F. The inside of the jug is therefore hot as compared with the liquid to be put in it, so one must be careful in pouring it in. Moisture doesn't touch a hot stove, since it is in the spheroidal state. The liquid air is also in the spheroidal state until the inside of the flask is cooled. If the lip of the flask is cooled too quickly the lip collapses. The liquid should be poured in a little at first, and then with a swirling motion.

Wide-mouthed jars or bottles for the experiments are made silvered and unsilvered, and cost about four dollars each. The liquid air boils away quickly in the unsilvered ones and less rapidly in the silvered bottles.

The liquid is transferred at once to the bottle, and is in the spheroidal state. It is a light blue in color and has a density of .808 gram per cubic centimeter. The boiling point of liquid nitrogen is about −195°C., and that of oxygen −183°C. Heat boils off the nitrogen first leaving almost pure oxygen. If we take about 100 cc. of liquid air and a large quantity of water, and, holding the receptacles by the edge, pour the air into the water, we see little bubbles going to the bottom. These are probably rather pure oxygen. The air floated on the water at first. When enough heat went from the water to the air, it evaporated the nitrogen and left oxygen. The oxygen sinks, and rises as a gas.

Experiments with liquid air may be divided into three groups as follows:

1. Those depending on the low temperature of liquid air.
2. Those depending on the fact that it expands 850 times on evaporation.
3. Those depending on the fact that nitrogen evaporates first leaving the oxygen (combustion experiments).

Group 1. Experiments depending on the low temperature of liquid air.

(1) *Carnation experiment.* A carnation is used because its petals are not too fleshy. The flower is held in the hand and dipped into the liquid air. As the hand is not touching the liquid, it is not harmed. The petals become brittle and are shattered by a slight blow.

(2) *Cranberry experiment.* Cranberries placed in the liquid, after a few minutes become very hard, and when dropped on the table sound like marbles.

(3) *Lead bell.* A circle of sheet lead is placed on a form and spun into a bell shape. A clapper and a wooden handle are added. The bell is nonresonant, but after a few minutes in the liquid air, its resonant qualities are increased.

(4) *A rubber ball*, after a few minutes in the liquid, is shattered when thrown on the floor.

(5) *Mercury hammer*. At first a pill-box was used as a mold, but was found to be unpeelable when the mercury was frozen. A box made of drawing paper worked better, and peeled off rather easily, leaving the mercury with a shiny surface. The bottom of the box should be supported by a zinc washer. The mercury is poured into the box, placed in the liquid air and a wooden handle inserted in the mercury. After it is frozen the paper is removed. The mercury may be handled with the hand as it is a rather poor conductor of heat and the heat from the hand is not conducted away very rapidly. The hammer thus made may be used to hammer a large headed nail into a piece of wood. It may then be placed in water, when the mercury melts, freezing the water around it to form a shell of ice. Alcohol may be used instead of water, but there is some risk, as some oxygen is likely to get into the alcohol. Also freezes from the alcohol are painful if it touches the hand, and other people may get burned later, if they come in contact with it on the table.

(6) *Effect on conductivity*. A cell, a 1.5 volt flashlight bulb, and a coil of about 15 ohms resistance are connected in series. Due to the high resistance, the bulb gives off only a barely perceptible illumination. By lowering the coil into liquid air, the conductivity increases and the bulb glows more brightly. The same thing happens if the coil is enclosed in a glass tube before immersing it, thus showing that the effect is not caused by the liquid soaking into the coil and shortcircuiting it.

(7) *Lead spring*. A coil of lead has little resiliency at ordinary temperature, but after immersion in liquid air, and weighting with a 100 gram weight it bobs up and down when set in motion.

(8) *Expansion ball and ring*. The usual experiment reversed. The ball is cooled until it contracts. In industry this is made use of when parts are fabricated by cooling, fitting into place, and allowing to expand e.g., putting crank pins in refrigerator compressors.

Group 2. Dependent on the fact that liquid air expands about 850 times on evaporation.

(9) Liquid air is led from a test tube having a stopper and tube into the toy steam engine. The latter runs by expansion of the liquid air. Efficiency of an engine run in this way would be about 1%. That of the uniflow steam engine is about 18%. This method would never be used. A glove is worn in case the stopper should blow out.

(10) Inflating a toy balloon.

(11) Playing a clarinet or whistle. A whistling tea-kettle.

(12) Liquid air is placed in a tea-kettle on a cake of ice where it boils merrily. A frost forms on the outside, composed of water vapor and carbon dioxide which have condensed and frozen. There is a cracking noise due to the contraction of the ice on cooling.

Group 3. Experiments depending on combustion.

Some liquid air is allowed to stand until the nitrogen has boiled away

leaving the oxygen. A glowing wood splint is ignited and lowered into the liquid. It bursts into flame and burns brightly under the liquid.

(14) A cigar is immersed for a few minutes until it has soaked up oxygen. When held in some tongs and ignited it burns like a Roman candle. Cheap cigars are best for this experiment as they are dryer.

(15) Enough of the temper is removed from a watch spring to make it stay straight. The ends are wound with cotton string, and dipped first in carbon disulphide and then in sulphur. It burns in liquid air. A deep half-round iron dish is used to prevent the light harming the eyes of the audience, and dark glasses are worn by the demonstrator. The steel burns at about 4500°F., so there is a difference of from −300°F. to 4500°F. in the space of one inch.

(16) Pouring liquid air through a hat.

(17) Cooking an egg in a pan on a cake of ice using liquid air congeals the egg, but is really a fake, as far as cooking is concerned.

PROBLEM DEPARTMENT

Conducted by G. H. Jamison
State Teachers College, Kirksville, Mo.

This department aims to provide problems of varying degrees of difficulty which will interest anyone engaged in the study of mathematics.

All readers are invited to propose problems and to solve problems here proposed. Drawings to illustrate the problems should be well done in India ink. Problems and solutions will be credited to their authors. Each solution, or proposed problem, sent to the Editor should have the author's name introducing the problem or solution *as on the following pages.*

The editor of the department desires to serve its readers by making it interesting and helpful to them. Address suggestions and problems to G. H. Jamison, State Teachers College, Kirksville, Missouri.

SOLUTIONS AND PROBLEMS

Note. Persons sending in solutions and submitting problems for solutions should observe the following instructions.

1. Drawings in India ink should be on a separate page from the solution.

2. Give the solution to the problem which you propose if you have one and also the source and any known references to it.

3. In general when several solutions are correct, the one submitted in the best form will be used.

LATE SOLUTIONS

1704. *Arthur Danzl, Collegeville, Minn.; Walter R. Warne, Rochester, N. Y.*
1700. *M. Gordon Duvell, Cincinnati, Ohio*

SOLUTIONS OF PROBLEMS

1705. *Proposed by Felix John, Pittsburgh, Pa.*

Find prime factors of:

$$16x^4+81y^8+256z^{12}-72x^2y^4-288y^4z^6-128x^2z^6.$$

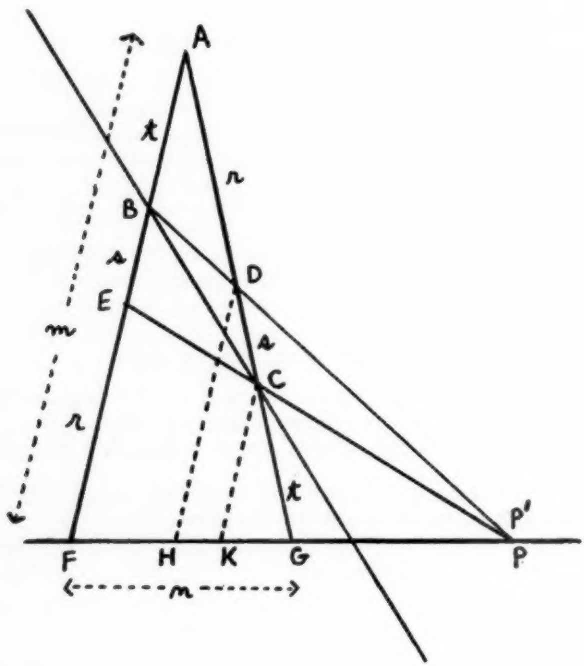
Solution by Miss Jeanne Thompson, San Antonio, Tex.

$$\begin{aligned} f(x) &= 16x^4+81y^8+256z^{12}-72x^2y^4-288y^4z^6-128x^2z^6 \\ &= (4x^2-9y^4+16z^6)^2-256x^2z^6 \\ &= (4x^2-9y^4+16z^6+16xz^3)(4x^2-9y^4+16z^6-16xz^3) \\ &= [(2x+4z^3)^2-9y^4][(2x-4z^3)^2-9y^4 \\ &= (2x+4z^3+3y^2)(2x+4z^3-3y^2)(2x-4z^3+3y^2)(2x-4z^3-3y^2). \end{aligned}$$

Solutions were also offered by G. H. Earle, Cleveland, Heights, Ohio; C. W. Trigg, Los Angeles, Calif; A. B. Curtis, San Antonio, Tex.; John Hoty, Cornwall, N. Y.; George Ross, Balyn, N. Y.; Joseph M. Synnerdahl, Chicago, Ill.; Brother Felix John, Pittsburgh, Pa.; Roy Wild, New Boston, Mo.

1706. *Proposed by Aaron Buchman, Buffalo, N. Y.*

Fixed points B and C are on the sides of a fixed angle A. From a variable point P, PB and PC are drawn. PB cuts AC at D and PC cuts AB at E so that $CD=BE$ where CD and BE are measured from C and B in opposite directions with respect to A. Find the locus of point P.



Solution by Proposer

Extend AB to F so that $BF=AC$ and extend AC to G so that $CG=AB$. Draw FG. The locus of point P consists of the two lines FG and BC.

Proof

Construct DH and CK parallel to AF. Let D lie between A and C. Let

$$AD=r, \quad DC=s, \quad CG=t.$$

Then

$$AB=t, \quad BE=s, \quad EF=r, \quad DH=(s+t), \quad CK=t.$$

Let

$$AF=AG=(r+s+t)=m, \quad \text{and let} \quad FG=n.$$

Then

$$KG=\frac{nt}{m} \quad \text{and} \quad HG=\frac{n(s+t)}{m}\cdot$$

Let BD cut FG at P. Then

$$\frac{FP}{HP}=\frac{BF}{DH} \quad \text{or} \quad \frac{FG+GP}{HG+GP}=\frac{BF}{DH}.$$

Substituting for FG, HG, BF, and DH, and solving for GP

$$GP=\frac{tn(m-r)}{m(r-t)}\cdot \tag{1}$$

Let EC cut FG at P'. Then

$$\frac{FP'}{KP'}=\frac{EF}{CK} \quad \text{or} \quad \frac{FG+GP'}{KG+GP'}=\frac{EF}{CK}.$$

Substituting for FG, KG, EF, and CK, and solving for GP'

$$GP'=\frac{tn(m-r)}{m(r-t)}\cdot \tag{2}$$

From (1) and (2), $GP=GP'$ and P coincides with P'. Thus BD and EC intersect on FG, and the locus of point P is a portion of FG.

But, a similar proof obtains when D is outside line segment AC, except that when D is on AC extended, s is negative, when D is on CA extended, r is negative, and when D is on AG extended, s and t are negative. Thus, it is easily shown that all of FG is part of the locus of point P, since the above algebraic derivation is reversible.

If we take the trivial case $CD=BE=0$, BC is part of the locus.

Thus the complete locus of point P consists of the two lines FG and BC.

Solutions were also offered by Mrs. Walter R. Warne, Rochester, N. Y.; Abert Dyke, Rochester, N. Y.; Matie Smith, Romulus, N. Y.; John Hoyt, Cornwall, N. Y.

1707. *Proposed by E. R. Haney, Hayts Corners, N. Y.*

Show that x cannot be real in $\tan^3 x=\tan(x-a)$ if $\sin A>1/3$

Solution by A. B. Curtis, San Antonio, Tex.

The equation may be written

$$\tan^4 x+\frac{\tan^3 x}{\tan A}-\frac{\tan x}{\tan A}+1=0.$$

Writing as the difference of two squares and factoring, we have

$$\left(\tan^2 x+\frac{\tan x}{2\tan A}+1\right)^2-\frac{\tan^2 x}{4\tan^2 A}(1-8\tan^2 A)=0.$$

$$\left[\tan^2 x+\frac{\tan x}{2\tan A}(1+\sqrt{1-8\tan^2 A})-1\right]$$

$$\cdot\left[\tan^2 x+\frac{\tan x}{2\tan A}(1-\sqrt{1-8\tan^2 A})-1\right]=0.$$

tan x will be read if the discriminant >0, that is, if

$$1+4\tan^2 A\pm\sqrt{1-8\tan^2 A}>0.$$

this expression will be positive if

$$8\tan^2 A\leqq 1$$

or

$$\tan A\leqq\frac{1}{\sqrt{8}}$$

$$\sin A\leqq 1/3.$$

Hence x cannot be real if $\sin A>1/3$.

Solutions were also offered by Aaron Buchman, Buffalo, N. Y.; and the proposer.

1708. *Proposed by Alvan Saxton, Watkins, New York.*

Show that the sum of the squares of the distances of the center of the inscribed circle of triangle ABC to A, B, and C is

$$ac+bc+ab-\frac{6abc}{a+b+c}\cdot$$

First Solution by C. W. Trigg, Los Angeles City College

Let I be the incenter and A' be the point of contact of the incircle with BC. Then $(CI)^2=r^2+(A'C)^2=r^2+(s-c)^2$, and two similar relations. Here $2s=a+b+c$. It is wellknown that the area of a triangle $=\frac{1}{2}r\ (a+b+c)$ $=\sqrt{s(s-a)(s-b)(s-c)}$. It follows that

$$(AI)^2+(BI)^2+(CI)^2=(s-a)^2+(s-b)^2+(s-c)^2+3r^2$$

$$=\frac{(b+c-a)^2+(a-b+c)^2+(a+b-c)^2}{4}+\frac{12s(s-a)(s-b)(s-c)}{(a+b+c)^2}$$

$$=\frac{3(a^2+b^2+c^2)-2(ab+bc+ca)}{4}+\frac{3(a+b-c)(a-b+c)(-a+b+c)}{4(a+b+c)}$$

$$=ab+bc+ca+\frac{3}{4}\left[a^2+b^2+c^2-2(ab+bc+ca)+\frac{(a^2-b^2+2bc-c^2)(-a+b+c)}{a+b+c}\right]$$

$$=ab+bc+ca-6abc/(a+b+c).$$

Second Solution by John P. Hoyt, Cornwall, N. Y.

Letting I be the incenter and r the inradius, we have

$$AI=r\csc A/2$$

$$BI=r\csc B/2$$

$$CI=r\csc C/2$$

$$\therefore\quad \overline{AI}^2+\overline{BI}^2+\overline{CI}^2=r^2(\csc^2 A/2+\csc^2 B/2+\csc^2 C/2).$$

But

$$r^2=\frac{(s-a)(s-b)(s-c)}{s}$$

where s is semi-perimeter, and

$$\csc^2 A/2=\frac{bc}{(s-b)(s-c)}$$

$$\csc^2 B/2=\frac{ac}{(s-a)(s-c)}$$

$$\csc^2 C/2=\frac{ba}{(s-a)(s-b)}\cdot$$

Substituting these values in the expression for $AI^2+BI^2+CI^2$ we get the desired result

$$ac+bc+ab-\frac{6abc}{a+b+c}\cdot$$

Solutions were also offered by Reuben Baumgartner, Freeport, Ill.; Geraldine Rice, Norman, Okla.; Brother Felix John, Pittsburgh, Pa.; George J. Ross, Brooklyn, N. Y.; George W. Rosison, Steamburg, N. Y.; Frank Harden Brook, Auburn, N. Y.; Mae Hayts, Borners, N. Y.; Walter R. Warne, Rochester, N. Y.; Mrs. Walter Warne, Rochester, N. Y.; A. B. Curtis, San Antonio, Tex.; Roy Wild, New Boston, Mo.

1709. *Proposed by Jerry Messler, Key West, Florida.*

Solve (completely)

$$x^{3/2}+y^{2/3}=3x \qquad (1)$$

$$x^{1/2}+y^{1/3}=x. \qquad (2)$$

Solution by Brother Felix John, Pittsburgh, Pa.

Solve (2) for $y^{1/3}$ and square:

$$y^{2/3}=x^2-2x^{3/2}+x. \qquad (3)$$

Substitute (3) in (1) and collect terms:

$$x^2-x^{3/2}-2x=0. \qquad (4)$$

Factor (4):

$$x(x^{1/2}-2)(x^{1/2}+1)=0. \qquad (5)$$

Solving (5):

$$x=0 \quad \text{and} \quad 4. \quad x^{1/2}+1=0 \text{ is not a solution.}$$

Substituting in (2):

$$y=0 \quad \text{and} \quad 8.$$

Hence (0, 0) and (4, 8) are the complete solutions.

Solutions were also offered by Joyn P. Hoyt, Cornwall, N. Y.; Joseph M. Synnerdahl, Chicago, Ill.; Arthur Danzl, Collegeville, Minn.; Jerry Messler, Key West, Fla.; Andrew Dunlap, Ovid, N. Y.; Isabel McKay, Buffalo, N. Y.; H. H. Robinson, N. Y.; John Bryant, McDuffietown, N. Y.; Walter R. Warne, Rochester, N. Y.; M. Gordon Dunall, Cincinnati, Ohio.

Solved by A. B. Curtis, San Antonio, Tex.

1710. *Proposed by Arthur Brooks, Ledger, New York.*

Prove that there is only one set of real values of s, y, z, which satisfy the equation

$$(1-x)^2+(x-y)^2+(y-z)^2=\tfrac{1}{4}.$$

There seems to have been an error in submitting this problem. Mr. A. B. Curtis, San Antonio, Texas shows that there are many sets of real values of x, y and z which satisfy the equation.—Editor.

STUDENT HONOR ROLL

The editor will be very happy to make special mention of high school classes, clubs, or individual students who offer solutions to problems submitted to this department. Teachers are urged to report to the Editor such solutions.

1704. *Matsunoin Mac Kozawa, Phineas Banning H. S., Wilmington, Calif.*

PROBLEMS FOR SOLUTION

1723. *Proposed by D. L. Mac Kay, New York City.*

Solve for x:

$$7^x+8^x=9^x.$$

1724. *Proposed by Walter R. Warne, Rochester, New York.*

Solve:

$$\frac{x^2}{y^2}+\frac{y^2}{x^2}+\frac{x}{y}+\frac{y}{x}=\frac{27}{4}$$
$$x^2+y^2=20.$$

1725. *Proposed by Flora Bell, McDuffietown, New York.*

A number of three digits in scale of 7 when expressed in scale 9 has the order of its digits reversed. What is the number?

1726. *Proposed by Frank C. Brady, Seneca Falls, New York.*

Find the condition in terms of a, b, and c, that

$$x^5-10a^3x^2+b^4x+c^5=0$$

has three equal roots.

1727. *Proposed by John P. Hoyt, Cornwall-on-Hudson, New York.*

If A and B are fixed points, BX an indefinite line making a fixed angle ABX', C any point on BX', CBJ and ACE equilateral triangles, and F the mid point of EJ. Find the locus of F as C moves along BX.

1728. *Proposed by Thomas A. Pickett, So. Weymouth, Mass.*

How many different right triangles are there whose sides are integers less than 100?

Now, more than ever, it is imperative that the schools play an active part in keeping open the channels of truth and in teaching young people to know and to seek these channels. The schools must preserve the vital distinction between intelligent analysis of propagandist doctrine on the one hand and morbid states of sterile skepticism and negation on the other. Emphasis must remain on positive faith in the American way of life.—*Resolution of the American Association of School Administrators, Atlantic City*, February 27.

SCIENCE QUESTIONS

June, 1941
Conducted by Franklin T. Jones,
10109 Wilbur Avenue, SE, Cleveland, Ohio

Contributions are desired from teachers, pupils, classes and general readers. Send examination papers from any source whatsoever, questions on any part of the field of science, tests, questions having to do with the pedagogy of science—in fact, anything that appeals to the reader or might appeal to other readers; also, anything that will help to make the subjects arrayed under SCIENCE more useful or more interesting to teachers and pupils. Select your own topic. It will, most likely, be interesting to others.

We will endeavor to get answers to all reasonable questions. It is always valuable to get questions whether they can be answered or not.

Contributors to SCIENCE QUESTIONS are accepted into the GQRA (Guild of Question Raisers and Answerers).

Classes and teachers are invited to join with others in this co-operative venture in science.

INTEREST RAISERS IN ELEMENTARY SCIENCE

Please try the following questions on a class—whether of the same age as the pupils who proposed them or some other age.

If you like, send some of the original papers of the pupils answering, either from one pupil for the entire list or separate questions and answers from individuals.

Teachers are invited to get their classes to submit sets of questions and answers for this series.

Summer school classes whether of teachers or pupils are invited to send lists for publication in October, November and December, 1941.

I-R's Nos. 31 to 40 are taken some from Questions asked by an Eighth Grade Boys' Class from Public School No. 54, Indianapolis, Mrs. Hellen Aufderheide, teacher (Elected to the GQRA No. 370), and the rest from a list of questions submitted by the Fifth and Sixth Grade Elementary Science classes of Miss Clara Headapohl, Warner School, Cleveland (Elected to the GQRA, No. 369).

Answers are desired. Submit to your classes. "Good answers" will be recognized by election to the GQRA.

31. Why is warm air lighter than cold air?
32. "When I stepped up on the porch at noon, I noticed a blanket of snow hanging down about a foot over the edge of the porch roof with nothing supporting it. Why didn't it fall?"
33. Why does a whale have to come up to the surface for air?
34. "If a lumber company cuts down the trees in a forest, how might that harm a farmer miles away?"
35. What becomes of water that evaporates from the earth's surface?
36. "In a certain song a lover tells his lady love that he will love her until the sands of the desert grow cold. How long will that be?"
37. Why does warm air rise and cool air stay down?
38. "The earth rotates at the speed a little more than a thousand miles an hour from west to east. How is it that an airplane traveling at the rate of only four hundred miles an hour can get from New York in the east to San Francisco in the west?"

39. Why doesn't a steel battleship sink?
40. "When I was watching my mother measure milk for cocoa, I noticed that the milk was higher than the cup. Why didn't the milk run over the edge of the cup?"

SUMMERTIME QUESTIONS

To keep your mind pleasantly occupied this summer take along your June copy of School Science and Mathematics *and answer some of the following.*

924. *Proposed by Philip B. Sharpe (GQRA No. 262), Greenwich, N. Y.*

"Speaking of simple machines that are not listed in the classical six, what machine is this?

"Two parallel ropes about eight inches apart became slack. To tighten them we draw them together in the middle with a piece of twine. (Try it on your boat trailer.)"

925. *Proposed by J. M. Synnerdahl (GQRA, No 129), St. Xavier College, Chicago, Ill.*

"A button is suspended by a thread in a clear glass bottle. The cork is sealed in the bottle. Sever the string so that the button falls; but do not uncork or break the bottle."

926. *Proposed by Dr. J. Russell Bright, Wayne University, Detroit, Mich.*

Chemistry—Homework 1.

"Consider all the following statements for they are helpful in a correct solution of the problem.

"Five gaseous elements are under consideration (*A*, *B*, *C*, *D*, and *E*).

(1)—*A* combines easily with all elements listed except *B*.
(2)—*A* combines with *C* to yield a compound which is 17.6% *A* and 82.4% *C*.
(3)—*B*, *C*, and *D* are present in the air.
(4)—*D* is more electronegative than *E*.
(5)—*A* reacts with *C*, *D*, and *E* to form typical co-valent hydrides.
(6) The weight of 22.4 liters of *E* is 70.92 grams.
(7)—The density of *B* is approximately 100% greater than *A*.
(8)—*D* has six L electrons.
(9)—The molecular weight of *C* is 12½% less than that of *D*.
(10)—*D* is heavier than air.

I. Write the formula for each element.
II. Illustrate or explain each of the above ten statements.
III. Make a schematic diagram showing an electronic structure for each element.
IV. What is the commercial source of each?
V. Prepare a table showing physical properties and uses of the element."

927. *Borrowed from The Double Bond's "Brain Teasers"*

"This is one that appeared in the Pioneer some time ago.

"A grocer, who was quite handy with tools, made himself a balance scale for use in the store. He was extremely proud of his handiwork until he started to use it.

"A customer had picked out a certain ham and asked to have it weighed. The grocer put it in the left pan and balanced it with weights in the right hand pan. The weight of the ham was found to be 7 lb.

"The customer was somewhat suspicious of the scales so the grocer sought

to prove their accuracy by weighing the ham in the other pan. Now the ham weighed 9 lb. 2 oz.

"The grocer then took the pans to another store and found that they weighed exactly one pound. With this information he then went back and calculated the weight of the ham. What was it?"

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928. *Pointers on Poisonous Plants—Consumers' Guide, June, 1940*

DON'T EAT: Pokeweed seeds or roots; Chinaberry; Castor Bean seeds or leaves, or roots; Horse Chestnut seeds; Water hemlock; Poison hemlock; Jimson weed; Black nightshade; European bittersweet; Mushrooms (unless you are an expert).

DON'T TOUCH: Poison ivy; Poison sumac (white berries); Poison oak; Snow-on-the-Mountain; Showy lady slipper.

(*Learn to identify the above before you start on your vacation.*)

FLOWERS IN THE SICK ROOM

929. *Proposed by W. Ming Foo (Elected to the GQRA, No. 405), Rodney Wilson High School, St. Johns, Michigan.*

"In my eleventh grade chemistry class the teacher encourages us to bring in outside subjects of interest.

"Somehow we got into a discussion of why flowers are taken out of a sickroom at night. Between us, we managed to give a few plausible answers, but most of them were not entirely satisfactory.

"Therefore, I am writing you for the scientific reason for removing flowers from sick rooms."

Readers of SCHOOL SCIENCE AND MATHEMATICS are requested to answer to the Editor.

NEAL WANTED TO KNOW AND HERE ARE ANSWERS

From Nathan A. Neal (GQRA, No. 365), James Ford Rhodes High School, Cleveland, Ohio

921. "What are *five* of the most valuable facts (or by-products) that I, as a pupil, got out of my high school physics class this year?"

922. "What are *five* of the most valuable facts (or by-products) that I, as a teacher, believe my pupils got out of my physics class this year?"

Answer to 921 by Aurelia Trudnowska (Elected to GQRA, No. 387), Riverside High School, Buffalo, N. Y.

"The study of physics results in many useful by-products. Foremost is knowledge. We are surprised that nature does not work in scatterbrain fashion but that its every act depends upon unchangeable rules based on the principle of cause and effect. This rouses our interest in the study of laws by which all natural phenomena are governed and regulated. By learning these facts, our skill broadens and we can both earn and save money by making practical use of what we have learned. We save money by being able to mend the thousand and one things that break in the fixtures and other household appliances within our own home. Our earning power rises when we perform similar services for others or secure employment because of our knowledge of physics. We all know that nature is a huge reservoir of unlimited power and energy. Many a student of physics will probably succeed in harnessing some of these friendly giants for the good of

mankind and, at the same time, make a fortune by useful invention. Physics directs the mind of the student through channels of clear thinking and makes him a logical thinker. This useful ability he can employ with equal effectiveness towards the solution of his own personal problems. Troubles and obstacles which may confront him will likely be resolved by his own thinking and not leaning on others. Physics quickens curiosity and stimulates imagination. Delving into the secrets of nature gives one just as much joy and satisfaction as digging up the treasures of ancient civilization and is just as entrancing. As for imagination, what can expand its wings more than watching the behavior of atoms and electrons. Here, with the mind's eye, we see the invisible as well as the visible in nature. We look at the atoms of matter in motion, at rest and even follow their course until we can actually see their invisible motion with our bodily eyes as in electrolysis. These are but a few of the useful by-products acquired by a student of physics and all are helpful to him.

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922. *Answer by Louis T. Masson (GQRA, No. 52), Riverside High School, Buffalo N. Y.*

Below is my reply to the question:

"From the teacher's standpoint, no single fact or group of facts in physics stands out, as we draw to the end of the year's work. Each day's facts and procedures are focussed to a goal beyond mere booklearning. That goal includes habits, attitudes, ambitions, and so forth. To put it in language which our younger generation may better understand, we might say:

"1. 'Look beyond the end of your nose constantly,'—get the habit of preparing and planning in physics, so that you will be efficient in preparing and planning your life's work.

"2. 'Nothing is impossible.'—develop the state of mind in which all things become a constant challenge for your solution.

"3. 'The greatest unexplored territory lies directly beneath your own hat,'—come to realize that the talents you actually make use of daily are but a tiny part of all the talents and abilities with which nature has so bountifully endowed you.

"4. 'Fight! Fight! Fight!,'—we say it to our teams and expect it of our athletes. Let's save a little for our own needs. Use the 'downs' of your ups and downs to gather momentum to reach even higher up and considerably better.

"5. 'Most of the shadows in our lives come from standing in the way of our own sunshine,'—above all, keep cheerful and be a good sport, for then your friends and accomplishments will be many indeed."

In answer to his own question, 922, Nathan A. Neal (GQRA, No. 365) writes:

"Some weeks ago I was asked to co-operate with Franklin R. Bemisderfer (GQRA, No. 6), and Arthur O. Baker (GQRA, No. 364), in writing a statement on what we believed to be the important facts and by-products of physics in terms of Asst. Supt. Bryan's listing of seven major objectives for high school education. These constitute my rather full answer to question 922." (*Unfortunately, lack of space prevents inclusion in this issue.*)

RHODES vs DEXTER

Mr. Neal's pupils at James Ford Rhodes High School sent a list of twenty-five questions on physics to the pupils of Virgil Henry (GQRA, No. 271), at Dexter, New Mexico. The latter responded with answers to a very considerable number of these questions.

Space in this issue does not permit publishing the questions, nor the answers; but a number of additional members of the GQRA are elected from Dexter because of the excellence of the answers. Their names appear below. It is hoped that the list of questions and some of the answers may be printed in SCIENCE QUESTIONS for October, 1941.

GQRA—NEW MEMBERS, JUNE, 1941

From Dexter, New Mexico,

396. Wanda Lunsford; **397.** Helen Johnson; **398.** Florence Sterrett; **399.** Veneta Coats; **400.** Mary Elizabeth Rutledge.

From Mercy High School, Milwaukee, Wisconsin,

401. Dorothy Brunette; **402.** Margaret Meyers; **403.** Elizabeth Van Gastel; **404.** Lucille Pelt.

From Rodney Wilson High School, St. Johns, Mich.

405. W. Ming Foo.

JOIN THE GQRA!!!

BOOKS AND PAMPHLETS RECEIVED

An Introductory Course in College Physics, by Newton Henry Black, *Assistant Professor Emeritus of Physics, Harvard University.* Revised Edition. Cloth. Pages viii+734. 15×23.5 cm. 1941. The Macmillan Company, 60 Fifth Avenue, New York, N. Y. Price $3.75.

Psychology, by John J. B. Morgan, *Professor of Psychology, Northwestern University.* Cloth. Pages xxi+612. 14×21.5 cm. 1941. Farrar and Rinehart, Inc., 601 W. 26th Street, New York, N. Y. Price $3.00.

Physics for Secondary Schools, By Oscar M. Stewart, *Professor of Physics, University of Missouri,* and Burton L. Cushing, *Head of the Department of Science, East Boston High School, and Lecturer on the Teaching of Physics at the Harvard Graduate School of Education.* Revised Edition. Cloth. Pages viii+760. 12.5×19.5 cm. 1941. Ginn and Company, Statler Office Building, Park Square, Boston, Mass. Price $1.80.

Arithmetic in Education. The Final Report of the National Council Committee on Arithmetic. Cloth. Pages xii+335. 15×23 cm. 1941. Bureau of Publications, Teachers College, Columbia University, New York, N. Y. Price $1.25.

A Mathematician's Apology, by G. H. Hardy. Cloth. Pages vii+93. 12×18.5 cm. 1940. The Macmillan Company, 60 Fifth Avenue, New York, N. Y. Price $1.00.

Biology Workbook, by B. B. Vance, *Chairman of Science Department, Daniel Kiser High School, Dayton, Ohio;* C. A. Barker, *Former Instructor of Biology, Steel High School, Dayton, Ohio;* D. F. Miller, *Associate Professor of Zoology and Supervisor of Teacher Training in Biological Sciences, Ohio State University;* and Edited by W. R. Teeters, *Supervisor of Physical and Biological Sciences, St. Louis Public Schools.* Paper. Pages iv+316. 18×26 cm. 1941. J. B. Lippincott Company, 333 West Lake Street, Chicago, Ill. Price 92 cents.

BRIEF TRIGONOMETRY, by Arthur R. Crathorne and Gerald E. Moore, *University of Illinois*. Cloth. Pages v+121. 13.5×21.5 cm. 1941. Henry Holt and Company, 257 Fourth Avenue, New York, N. Y. Price $1.20.

TEXTBOOK OF CHEMISTRY, by Albert L. Elder, *Professor of Chemistry, Syracuse University*. Cloth. Pages viii+751. 15×23.5 cm. 1941. Harper and Brothers, 49 East 33rd Street, New York, N. Y. Price $3.75.

THE EARTH AND ITS RESOURCES, by Vernor C. Finch. *Professor of Geography, University of Wisconsin;* Glenn T. Trewartha, *Professor of Geography, University of Wisconsin;* and M. H. Shearer, *Westport High School, Kansas City, Missouri*. Cloth. Pages v+634. 15×23 cm. 1941. McGraw-Hill Book Company, 330 West 42nd Street New York, N. Y. Price $2.40.

ORGANIC CHEMISTRY, by Nicholas D. Cheronis, *Chicago City Colleges*. Cloth. Pages v+728. 15×23 cm. 1941. Thomas Y. Crowell Company, 432 Fourth Avenue, New York, N. Y.

ESSENTIALS OF ALGEBRA, SECOND COURSE, by Walter W. Hart, *Formerly Associate Professor of Mathematics, School of Education, University of Wisconsin*. Cloth. Pages viii+344. 12.5×20 cm. 1941. D. C. Heath and Company, 285 Columbus Avenue, Boston, Mass. Price $1.32.

EXPERIMENTAL FOUNDATIONS OF GENERAL PSYCHOLOGY, by Willard L. Valentine, *Professor of Psychology, Northwestern University*. Revised Edition. Cloth. Pages xvi+432. 14×21.5 cm. 1941. Farrar and Rinehart, Inc., 601 West 26th Street, New York, N. Y. Price $2.00.

THE ROCKEFELLER FOUNDATION, A REVIEW FOR 1940, by Raymond B. Fosdick, *President of the Foundation*. Paper. 64 pages. 15×23 cm. The Rockefeller Foundation, 49 West 49th Street, New York, N. Y.

RCA LABORATORIES, A NEW CENTER FOR RADIO RESEARCH, Addresses by David Sarnoff, *President, Radio Corporation of America*, and Otto S. Schairer, *Vice President, Radio Corporation of America, in Charge of RCA Laboratories*. Paper. 23 pages. 13.5×21 cm. 1941. Radio Corporation of America, RCA Building, 30 Rockefeller Plaza, New York, N. Y.

BOOK REVIEWS

REFERENCE BOOK OF INORGANIC CHEMISTRY, by Wendell M. Latimer, *Professor of Chemistry in the University of California*, and Joel H. Hildebrand, *Professor of Chemistry in the University of California*. Revised Edition. Cloth. Pages xii+563. 14×21 cm. 1940. The Macmillan Company, 60 Fifth Amenue, New York, N. Y. Price $4.00.

This edition is a general reference book in the field of inorganic chemistry. The authors have included the important facts of the recent developments in atomic, molecular, and crystal structure, atomic sizes, bond distances and bond energies. The chapter on atomic nucleus has been rewritten and includes the discoveries which have been made in the last ten years in nuclear physics. The authors have treated industrial processes with emphasis upon their chemistry relation to other industries and economic magnitude, rather than upon their mechanical features.

E. G. MARSHALL

SEMIMICRO QUALITATIVE ANALYSIS, by William Lloyd Evans, Alfred Benjamin Garrett, and Laurence Larkin Quill, *The Ohio State University*. Cloth. 246 Pages. 10.5×26.5 cm. 1940. Ginn and Company, 15 Ashburton Place, Boston, Mass. Price $2.00.

This book is a combined laboratory manual and textbook. The first one hundred and sixty pages covers the cations and anions.

A lecture demonstration exercise on the chemical conduct of the common cation is given before the students start on laboratory work. The purpose of this exercise is threefold.

1. To determine some of the specific properties of the common cations.
2. To find a method of separating the common cations into groups.
3. To show the difference in amounts used in macro and semi-micro analysis.

The procedure used in the study of each group is:

(1) Preliminary tests on precipitation and separation reactions, confirmatory test reactions, and supplementary reactions.
(2) Block outline of method of analysis.
(3) Flow sheet.
(4) Review questions.
(5) Supplementary questions.

At the end of each group of cations there is a laboratory record sheet to be filled out by the student.

These topics are discussed in the Theory of Qualitative Analysis:

1) Ions in solution.
2) The degree of dissociation.
3) Methods of expressing the concentrations of solutions.
4) Chemical reactions.
5) Equilibrium.
6) The ionization constant.
7) The solubility product constant.
8) Hydrolysis.
9) Complex ions.
10) Amophoteuc hydroxides.
11) The solubility of the sulphides.
12) The separation of the cation groups, I, II, and III.
13) Flame tests; the spectra.

The appendix includes: Reaction of the cations and anions; Table of solubilities; Notes on procedure of analysis; Preparation of reagents; Table of logarithms.

This is an excellent text for those students for whom elementary semimicro analysis is an integral part of their first or second year's study in chemistry.

E. G. MARSHALL

AN EXPERIMENT IN THE TEACHING OF GENETICS WITH SPECIAL REFERENCE TO THE OBJECTIVES OF GENERAL EDUCATION, by Austin Demell Bond. Teachers College, Columbia University Contributions to Education, No. 797. Cloth. Pages viii+99. 15×23 cm. 1940. Bureau of Publications, Teachers College, Columbia University, New York, N. Y. Price $1.85.

This is an investigation on the evaluation of the results of the type of education offered by the general college in this country. These general colleges provide a type of education designed fundamentally for active participation in a democracy. The particular area in the field of general education chosen to illustrate this evaluation is the subject of genetics.

The following questions are attempted to be answered in part by this study: 1. Is there an increase in number and accuracy of concepts in the field of heredity? 2. Has there been a reduction in the acceptance, by the students, of common superstitions concerning heredity? 3. Are students better able to apply principles from the field of heredity in arriving at conclusions with respect to specific situations after instruction than they were before? 4. Have they developed a more critical appraisal of authorities in this field? 5. Are students more accurate in the interpretation of data which are presented? 6. Will the instruction result in a change in opinions held with respect to international questions, imperialism, and those held toward members of certain races? If a change results what is its direction? 7. Can any changes found be related to difference in initial standing in the characteristic studied, effects of intelligence, or the teaching situation?

It would appear that this monograph could be of interest to those teachers particularly interested in curriculum building.

A. G. Zander

Animals in Action, by Gayle Pickwell, *Professor of Zoology at San José State College, San José, California*. Cloth. Pages xiii+190. 21.5×29 cm., 1940. McGraw-Hill Book Company, 330 West 42nd Street, New York, N. Y. Price $4.00.

This is a very interesting and lovely oversize volume on nature study. Its style is unique. It has a narrative type discourse interspersed with accurate information on the particular theme under discussion. This combination holds the attention of the reader throughout the perusal of the book. The principles of animal life processes and behaviour are understandingly portrayed. The book should appeal to the layman so interested as well as to the more professional type in this field. A list of the chapter headings gives an inkling of the content of the book. I. Why Know Animals? II. Animals At Home. III. Animals As Parents. IV. Animals Growing Up. V. Animals Getting Food. VI. Animal Protection. VII. Animals Getting Air. VIII. Animals Getting About. IX. Animal Kinds. X. How To Know Animals. The mechanical makeup of the book is excellent with all illustrations full page half tones. The chapter on animal photography is especially good.

A. G. Zander

This Living World, by C. C. Clark. *Associate Professor of General Science, New York University*, and R. H. Hall, *Instructor in General Science, New York University* First Edition. Cloth. Pages x+519. 15×23 cm. 1940. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York, N. Y. Price $3.25.

This is a non-technical text written for the college student who is not a science major. The material is of such a nature and so arranged that the non-science college student who uses the book may get a good working idea of modern biological science. A comprehensive insight to the modern living world is obtained in this way rather than by the use of the texts covering the field of the various special biological sciences. The subject matter is divided along these lines: changing concepts regarding life; features of the earth's crust; behaviour of the atmosphere and the sea; the nature of living matter; the development of life forms; life in the sea from the developmental standpoint; development of animal and human behaviour; comparative study of human anatomy and that of lower vertebrates; physical development of man from prehistoric to modern times; the structure, action and interaction of the parts of the human body. Interesting references follow each chapter. A statement accompanying

each reference telling of the general nature of the reference is a valuable adjunct to the book.

A. G. Zander

Adventures in Algebra, Second Course, by Murry J. Leventhal, *Chairman, Mathematics Department, James Madison High School, Brooklyn, New York*, and Charles Salkind, *Samuel Tilden High School, Brooklyn, New York*. Edited by F. Eugene Seymour, *Supervisor of Mathematics, State Education Department, Albany, New York*. Cloth. Pages xiv+493, 13.5×20 cm. 1941. Globe Book Company, 175 Fifth Avenue, New York, N. Y.

This text is designed for either a one or two semester course in second year algebra. By omitting certain topics designated by the authors as "course A" or "course B" the material may be reduced to a one semester course. In each set of exercises the minimum number of examples to be done by the slower pupil is indicated. Included also are honor problems to meet the needs of the more capable students.

Throughout the book one can see the stress upon the function concept and the attempt to integrate the material of mathematics. Many interesting practical applications of mathematics are included. The language is simple and the average pupil should find no difficulty in understanding it. The exercises are well graded and instead of being concentrated at the end of the chapter are distributed throughout the book where they can do the most good. The book is easy to read and thus should attract the pupil to its content. The illustrations are well done and add much to the attractiveness of the text. One of the chief features of the book is the gradual approach to new topics.

The text should be well received by pupils and teachers because of the wealth of material it contains and because of the excellent presentation of subject matter.

Charles A. Stone

Essentials of High School Algebra, by Walter W. Hart, *Formerly Associate Professor of Mathematics, School of Education, University of Wisconsin*. Cloth. 13×20 cm. Pages ix+582. 1941. D. C. Heath and Company, Boston. Price $1.60.

This book is designed for two courses in secondary algebra, and according to the author's preface contains enough material to meet the requirements in algebra for entrance to colleges and Universities, excepting the requirements in advanced algebra expected of entrants to certain technical schools. The material is sufficient to teach the essential skills and concepts of algebra. All puzzle problems and unnecessary abstractions have been omitted.

The author has used his skill in pedagogy by teaching one skill at a time and using mostly the inductive method of approach. The examples are well graded and the vocabulary employed is within the comprehension of the pupils. Preceding each unit will be found a preview which serves as an excellent motivating device. A thorough reviewing system is employed and includes reviews, unit tests, cumulative reviews and a full-year revew and test.

Arithmetic, geometry and trigonometry are taught in their relationship to algebra. In addition to a constant application of arithmetic, skill in its use is tested and remedial exercises are provided. The geometry includes a review of fundamental plane figures, an initial consideration of common solids, statistical graphs and mathematical graphs in relation to algebra. Trigonometry is introduced in a unit on indirect measurement. The mean-

ing and use of the tangent is included and optional sub-units on the sine and cosine follow.

The book is attractive and well illustrated and should find favor with both pupils and teachers.

CHARLES A. STONE

ELEMENTS OF GENETICS, by Edward C. Colin, Ph.D., *Chicago Teachers College*. Cloth. Pages xii+386. 15×22 cm. 1940. Blakiston Company, 1012 Walnut Street, Philadelphia, Pa. Price $3.00.

This book satisfies a need for more authoritative information on the application of the laws of inheritance to man. The book is designed primarily for use as a text and reference work for an elementary course in genetics. The author's aim, as stated in the preface, has been to present a clear and readable account of the elements of the science of genetics, with special emphasis upon the applications to man. The author has adopted the historical approach as the one most likely to gain the interest of the reader.

The introductory chapters include a sympathetic discussion of Mendel's life and work, a clear elucidation of the laws of inheritance, and a discussion of chromosomes, linkage, crossing over and the factor principle. Seven of the sixteen chapters are devoted wholly or in part to a discussion of the applications of the laws of inheritance to man. At the ends of the chapters the author has added a series of problems graduated in difficulty from simple problems at the beginning to more difficult ones near the end.

The text is well supplied with references to original sources of information and a Glossary has been appended. The figures, though not abundant, are well chosen for illustrative purposes, and the text contains a wealth of information. The reviewer considers it an excellent text for the group for which it has been prepared and one well worth the investment of the general reader.

HILMER C. NELSON
Wilson Junior College

INTRODUCTORY COLLEGE MATHEMATICS, REVISED EDITION, by William E. Milne, *Professor of Mathematics, Oregon State College*, and David R. Davis, *Associate Professor of Mathematics, State Teachers College, Montclair, New Jersey*. Cloth. Pages xvi+438 and ii+82 (five place tables). 1941. Ginn and Company, Boston, Massachusetts. Price $3.00.

This revision of a text that has been on the market for several years retains the general plan of organization of the original text, which made a definite attempt to correlate the material of Algebra, Trigonometry, Analytic Geometry, and Elementary Calculus, around the general theme of the concept of a function. The revision offers new material on sequences and series and on solid Analytic Geometry. Calculus is introduced in the second chapter, Trigonometry in the tenth chapter, starting with the functions of an acute angle.

The text is an excellent one and should be given careful consideration by anyone interested. There is a large number of problems of varying degrees of difficulty. A few minor points might be mentioned: in the treatment of parametric equations it is not made clear that the parametric equation may represent only a portion of the curve; in the treatment of fractional exponents the student might run into difficulty if he attempted to evaluate minus 2 with the exponent 3/2; in the treatment of logarithms a rule states one should find the mantissa from the tables, without a very clear explanation of the prior statement that the table contains only positive mantissas.

CECIL B. READ
University of Wichita

INTRODUCTION TO THE THEORY OF EQUATIONS, by Nelson Bush Conkright, *Assistant Professor of Mathematics, University of Iowa.* Cloth. Pages viii+214. 21×15 cm. 1941. Ginn and Company, Boston, Massachusetts. Price $2.00.

This text covers the material which has been traditionally included in a first course in the theory of equations, the assumption being that Calculus has been completed. Graeffe's method is treated in considerable detail, seventeen pages being devoted to the topic.

There is an ample supply of problems with a wide range in difficulty. In several cases the problems involve alternative proofs with hints and suggestions offered. Answers are provided to a portion of the problems in general, the odd numbered set. The illustrative examples are worked out in considerable detail. The book as a whole would appear to be very teachable.

CECIL B. READ
University of Wichita

FUNDAMENTAL MATHEMATICS, by Duncan Harkin, *Instructor in Mathematics, Brooklyn College, Brooklyn, New York.* Cloth. Pages xv+434. 14.5×23 cm. 1941. Prentice-Hall, Inc., 70 Fifth Avenue, New York, N. Y. Price $3.00.

This is an unusual text. It includes material that might be included in courses in History of Mathematics, Arithmetic, Algebra, Geometry, Trigonometry, and Calculus. The author has made an attempt to select material which is both useful and interesting. Illustrative of this type are such items as Finite Modular Arithmetic, Diophantine Analysis, MacNeish-Desargues Finite Geometry, Fourier Series. There are many quotations from the original sources and an unusually large number of problems of the puzzle or recreational type.

The first portion of the book reads almost like fiction, in fact one does not want to put the book down; the last portion of the book progresses much more rapidly. The contrast is extremely marked. This would make a fine book for a library, particularly as source material for mathematical clubs. It would be a good book to give a mathematics student leaving Junior College to help him see the interrelation of various courses. Whether or not it would make a good text depends on what the teacher wants. This will be a matter for the individual teacher to decide.

CECIL B. READ
University of Wichita

AN INTRODUCTORY COURSE IN COLLEGE PHYSICS, by N. Henry Black, *Assistant Professor Emeritus of Physics, Harvard University.* Second edition. Cloth. Pages viii+734. 15.5×23.5 cm. 1941. The Macmillan Company, New York, N. Y. Price $3.75.

This is a revision of a text which was first published in 1935. The author states that it is intended for students who have not had high school physics. The book follows the conventional order in the presentation of subject matter and in this regard differs little from the original text. There are some changes in wording which make for greater clarity, and the author gives somewhat more emphasis to the proper selection and handling of units in an equation; as for example in the applications of Young's modulus (p. 120 new, p. 125 old) and in the discussion of rotational inertia (p. 190 new, p. 189 old). The principal changes however are in the inclusion of considerable new material. Some topics which were omitted in the first edition, e.g. tides, are included in the revision. New material has also been added

in a discussion of a polar front theory of weather analysis and in the field of atomic structure the book has been brought up to date, including such recent developments as the discovery of the mesotron and the splitting of the uranium atom.

The troublesome question of units for mass, weight, and force is handled by using the terms "mass" and "standard-weight" interchangeably. The gram and the pound may refer either to mass or force depending on the context. Mass in an equation is used as wt./g. in this way neither the "poundal" nor the "slug" is introduced.

The topical outline at the beginning of chapters in the first edition is omitted but a short summary and a very excellent feature, the list of references at the end of each chapter have been retained. The problems are well selected and almost entirely new. Answers are given to a few representative problems. The book contains many excellent figures, line drawings, and cuts of famous physicists.

The emphasis is definitely on a physical rather than a mathematical interpretation, and an unusual number of illustrations and applications are drawn from many fields of everyday life. Some teachers will feel that for engineering students the explanations and illustrations are too lengthy and that sufficient technical material is not given. For a general class with little background in science the book is worthy of serious consideration.

R. R. HANCOX
Wilson Junior College
Chicago

METEOROLOGY, by D. S. Piston, *Physicist, The Twining Laboratories, Fresno, California*. Second edition. Cloth. Pages x+233, 14×21.5 cm. 1941. Maple Press Co., York, Pa. Price $3.00.

The author states that this book has been written primarily as an elementary text for college courses. For non-technical students with little background in science it would be very satisfactory. It should also be of interest to the general reader. It is written in non-technical language and in a style which is easily understood. The mathematics used is elementary.

There are nine chapters dealing with the atmosphere, the behavior of dry and moist air, radiation, cyclones and anticyclones, air masses, sources, and fronts, thunderstorms and tornadoes, maps and forecasting, and climatology. Several tables and a list of seventy-five problems complete the book. These problems should prove valuable from a teaching standpoint.

The book would hardly serve as a text for aviation students, since much material essential to this field has been omitted and emphasis has not been placed on points of most immediate interest to a pilot. For such students it might be valuable if read as an introduction to the subject of meteorology before undertaking more detailed and technical material.

R. R. HANCOX
Wilson Junior College
Chicago

TEXT AND TESTS IN ELEMENTARY ALGEBRA, by David Eugene Smith, and William David Reeve, both of *Teachers College, Columbia University*, and Edward L. Morss. Paper. Pages ii+318. 19×26 cm. 1941. Ginn and Company, Statler Office Building, Park Square, Boston, Mass. Price 92 cents.

In this book the authors have attempted to make a text in algebra that is not too closely bound by tradition, but is vitalized by giving more attention to those topics intimately associated with modern experience. Also they have not extended the degree of difficulty too far beyond the probable

needs of those taking the subject. And yet they have not made the assumption that the interest and purpose of all pupils will be limited by the amount of mathematics that is useful in making a living. Topics and methods of treatment are selected with the conception of mathematics as one of the most interesting of all subjects and one that constitutes a part of the cultural heritage of modern people as it has been for all generations. Some numerical trigonometry, logarithms, the slide rule, and historical notes serve to widen the mathematical horizon of the learner. Numerous tests in the text and separately printed survey tests enable the teacher to keep constant check on the progress of the work. Illustrations and problems are selected to give the book a present day atmosphere. The extra large pages make a very attractive book. Perhaps a more permanent binding would be justified for the book.

WALTER H. CARNAHAN
Shortridge High School
Indianapolis

ELEMENTARY MATHEMATICAL CONCEPTS, by James H. Zant, *Associate Professor of Mathematics*, and Ainsley H. Diamond, *Head, Department of Mathematics, Oklahoma, Agricultural and Mechanical College, Stillwater, Oklahoma*. Paper. 14.5×22.5 cm. 1941. Burgess Publishing Company, 426 South Sixth Street, Minneapolis, Minn. Price $1.50.

This book is designed for a freshman course in mathematics for non-science students. It presents certain topics from the hisorical and logical point of view. References at the ends of the chapters adapt the book to use by more advanced students or those with a more permanent interest in mathematics. Some of the subjects treated are elementary number theory, rational operations with numbers, fractions, exponents, stocks and bonds, insurance, compound interest and annuities, early history of geometry, and measurement. In planning a book of this type, naturally the personal judgment of the authors must decide from among the many topics which might possibly be of interest and profit to non-science students which should be presented and which should be omitted, and just what facts should be presented for each topic. Any reader of this book will look for certain topics which are not included, but certainly the authors have presented no topic which is not of universal interest. Their presentation is always logical and interesting. Some of the subjects presented will tax the comprehension of freshman college students, either science or non-science students unless careful and detailed presentation is made in class discussions. Interest in and profit from the book need not be confined to freshman college students, but even those familiar with the topics treated will enjoy reading the book.

WALTER H. CARNAHAN
Shortridge High School
Indianapolis

PLANE GEOMETRY, by F. Eugene Seymour, *Supervisor of Mathematics, New York State Department of Education, Albany, N. Y.*, and Paul James Smith, *Head of Department of Mathematics, East High School, Rochester, N. Y.* Cloth. Pages xi+467. 13.5×21.5 cm. 1941. The Macmillan Company, 60 Fifth Avenue, New York, N. Y. Price $1.60.

Textbooks are growing larger, including those for algebra and geometry. The Clark-Smith-Schorling Geometry has 450 pages, the new Welchons-Krickenberger has 502 pages, and the Seymour-Smith has 467 pages. But the pages of the Seymour-Smith are larger than the average, and so it has the most material of all. Any of these texts have about twice as much material as the books of fifteen years ago.

Both the C-S-S text and the W-K text contain work on analytic geometry and on solid geometry, but these topics are absent from the Seymour text. The increase in size in Seymour is due partly to such items as: 35 pages for the unit on loci, 16 pages to trigonometry, 25 pages to tests, and 28 pages to the application of reasoning to daily life situations. The number of corollaries of theorems is increased so as to include all generalizations which a pupil might wish to quote as reasons. Exercises are divided into A, B, and C groups according to difficulty. The basic concepts and the introduction to formal proofs are studied in great detail so that the unit on circles, or Book Two traditionally, is not reached until page 173.

Undoubtedly an experienced teacher welcomes such wealth of material. There is a tendency among authors and publishers to furnish books that meet all possible conditions, books that include materials for all levels of ability and interest, and materials from every topic that any organization or any curriculum report suggests. The author then leaves to the teacher the task of selecting appropriate material. Some teachers feel that if authors would assume some of this task the work of the teacher would be easier. The authors of the Herberg-Orleans Geometry (D. C. Heath & Co.) have written a smaller book (402 pages) in demonstrative plane geometry, and the Reichgott-Spiller Geometry (Prentice-Hall, 366 pages) is decidedly a text for classes that can profit more from seeing the applications than from demonstrating.

Joseph A. Nyberg
Hyde Park High School
Chicago

Shop Mathematics, by C. A. Felker, *Personnel Director, Marion Steam Shovel Company*. Cloth. Pages xii+380. 14.5×22.5 cm. 1941. The Bruce Publishing Company, Milwaukee, Wis. Price $2.20.

A recent publication *Shop Mathematics* by C. A. Felker seems to solve the text book problem of vocational schools and vocational departments of general high schools. Mr. Felker approaches the problem of the textbook with a splendid training both in theory and practical experience. Mr. Felker, formerly a high school mathematics teacher, is at the present time, personnel director of the Marion Steam Shovel Company. Thus he embodies in his work the requirements of industry as well as the manner in which material of this type should be presented to the average high school student.

Throughout the book shop mathematics is tied up with shop practice by means of practice material, questions on shop practice and descriptive material. The portions explaining the various measuring devices as well as the concrete illustrations of the various formulae are well done. The aim, throughout the applied mathematics is to acquaint the student with the information in handboks: to show how it is obtained and how it is applied. All explanations are clear, definite, practical and the illustrative problems are solved in detail. It is a timely text which should prove very useful not only to high school mathematics teachers and pupils but also to those who are preparing workers for the national defense jobs. This book is unusual in that it actually covers the mathematical needs of many phases of shop work.

John P. Alvir
Phillips High School
Chicago, Illinois

If you do not get your journal regularly notify Business Manager W. F. Roecker, 3319 N. 14th Street, Milwaukee, Wis.

SOME NEW SCIENCE BOOKS

COFFERDAMS, by Lazarus White and Edmund Astley Prentis. Cloth. Pages xxiv+273. 15×23.5 cm. 1940. Columbia University Press, Morningside Heights, New York, N. Y. Price $7.50.

A book for a specific purpose—to make readily accessible to engineers and contractors the knowledge of cofferdams gained chiefly in the great government project to provide a nine-foot channel in the Mississippi River from St. Louis to St. Paul. Elaborately illustrated.

GROWING TREES AND SMALL FRUITS, by H. B. Knapp, *Director, State Institute of Applied Agriculture, Farmingdale, L. I., N. Y.*, and E. C. Auchter, *Chief, Bureau of Plant Industry, United States Department of Agriculture.* Second Edition. Cloth. Pages xviii+615. 13.5×20.5 cm. 1941. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y. Price $2.75.

Excellent textbook for schools in the northern states where courses are given in fruit culture. Complete information on planting, cultivating, pruning, spraying, harvesting, packing, storing and marketing. Farmers and fruit growers will find it very useful.

SCIENCE ON THE MARCH, by John A. Clark, *Head of Department of Physical Science, Alexander Hamilton High School, Brooklyn, New York;* Frederick L. Fitzpatrick, *Professor of Natural Sciences, Teachers College, Columbia University, New York;* and Edith Lillian Smith, recently *Instructor, Boston Teachers College, Boston. Massachusetts.* Cloth. Pages xiii+572+x+iii. 14×21.5 cm. 1941. Houghton Mifflin Company, 2 Park Street, Boston, Mass. Price $1.72.

A new textbook for general science classes designed to assist young learners in developing a scientific approach to problems. Presented in problem form. Good teaching helps. Suggestions for club work.

EVERYDAY PROBLEMS IN SCIENCE, by Wilbur L. Beauchamp, *University of Chicago;* John C. Mayfield, *University High School, Chicago;* and Joe Young West, *Maryland State Teachers College.* Cloth. Pages xvi+752. 14×22.5 cm. 1940. Scott, Foresman and Company, 623 South Wabash Avenue, Chicago, Ill. Price $1.72.

Third edition of a book that has stood the test of classroom use. A new type of organization, carefully selected content, plenty of interest appeal, logical presentation of principles, simple apparatus for experiments, a book planned to meet completely the aims of high school general science.

TOURS THROUGH THE WORLD OF SCIENCE, by William T. Skilling, *State Teachers' College, San Diego, California.* Revised Edition. Cloth. Pages xiv+815. 12.5×19 cm. 1941. McGraw-Hill Book Company, 330 West 42nd St., New York, N. Y. Price $1.70.

Revised edition of a general science text that has had extensive use since 1933. Conventional type text, reliable, exceptionally strong on physical science.

NATURE GAMES BOOK, by Elmo N. Stevenson, *Professor of Science Education, Oregon State College.* Cloth 208 pages. 11.5×19 cm. 1941. Greenberg: Publisher, 67 West 44th Street, New York, N. Y. Price $2.50.

A book for the elementary science teacher, the nature camp director, and all others who teach children and direct their leisure activities. Gives the

age and grade for which each game is best suited, number of players required, whether it is for indoors or outside, and whether noisy or quiet. Complete directions for each game, instructions for variations, and hints for making it most effective and worth while.

MATERIALS OF INDUSTRY, by Samuel Foster Mersereau, *Chairman, Department of Industrial Processes, Retired. Brooklyn Technical High School.* Revised and Enlarged. Cloth. Pages xxiv+578. 13.5×20.5 cm. 1941. McGraw-Hill Book Company, 330 W. 42nd St. New York, N. Y.

A textbook for technical high schools, industrial and vocational schools. Thoroughly revised and brought up to date. Discusses all the principal materials used in industry, their sources, production, conversion into commercial products, general properties and uses, and their economic importance.

MODERN-LIFE CHEMISTRY, by Frank O. Kruh, *Summit High School, Summit, New Jersey;* Robert H. Carleton, *Summit High School, Summit, New Jersey;* and Floyd F. Carpenter, *Stivers High School, Dayton, Ohio.* Edited by W. H. Teeters, *Supervisor of Physical and Biological Sciences, St. Louis Public Schools, St. Louis, Missouri.* Cloth. Pages xxv+774, 13×20 cm. 1941. J. B. Lippincott Company, 333 West Lake Street, Chicago, Ill. Price $1.80.

A new type of high school chemistry text. Aims at better understanding and more intelligent action. Recognizes the necessity for training in scientific thinking. Made up of eleven units, each presenting several problems to be solved. Attractive, thought stimulating, reliable.

NATURE SMILES IN VERSE. A COLLECTION OF BI-ILLOGICAL POEMS. Compiled by Bernal R. Weimer, *Professor of Biology, Bethany College, West Virginia.* Cloth. Pages x+99. 15×23 cm. 1940. Price $1.50.

Some are clever, others witty, some provoke smiles, some nauseate, a few are real gems, many are abominable verse and not much better science.

Upon leaders in education, together with parents, rests the responsibility of giving to emerging youth sound vocational guidance before they must go to work. Educators more generally need to sponsor guidance programs, guidance clinics, and educational visits to industry for young people in order that they may be well informed about the possibilities and opportunities of apprenticeship . . . the tragedy of much of the well-intentioned but faulty guidance that is given to youth by persons unfamiliar with the world of work is that it fails to recognize that for many persons their greatest opportunities for growth, happiness, and service to society lies in the field of blue-collar rather than white-collar jobs.—*J. C. Wright, Assistant U. S. Commissioner for Vocational Education, in Atlantic City address,* February 24, 1941.

A few academicians look down their noses at vocational training, disdaining to call it education. Personally I believe that young people who have acquired some practical skills, who have learned to combine some general education and disciplined hands in a productive accomplishment, are better prepared to approach the hundred best books than the learner whose primary contact with the world of reality is merely through word symbols.—*John W. Studebaker, U. S. Commissioner of Education, Atlantic City address,* February 24, 1941.

WORLD-WIDE EDUCATION MEET

Michigan and its University will be host to one of the largest international educational meetings ever to be held in the Western Hemisphere when the New Education Fellowship convenes in Ann Arbor July 6–12.

More than a score of outstanding figures in the world of education, public affairs, literature, and the arts have been invited to speak before this international conference, which is expected to bring 2000 delegates from every corner of the earth.

Vice-President Henry A. Wallace and Secretary of State Cordell Hull are among the headline speakers listed on a tentative program just made public While the condition of world affairs at the time of the meeting will determine whether they will be able to attend, both have indicated their interest in and their desire to address the meeting.

Other speakers of world-wide reputation on the program include: Thomas Mann, author; John Dewey, American philosopher; Laurin Zilliacus, Finnish educator and international president of the New Education Fellowship; John W. Studebaker, U. S. Commissioner of Education; Carleton Washburne, president of the Progressive Education Association; Luis Sanchez Ponton, Mexican minister of education; Jonathan Daniels, author; Frederick Clarke, prominent English educator; Aldous Huxley, English author; Waldo Frank, lecturer; and Mrs. J. Borden Harriman, U. S. minister to Norway.

The New Education Fellowship is an international organization of educators devoted to solving the problems of civilization by the improvement of education. It has 51 national sections in countries the world over and is represented in the United States by the Progressive Education Association.